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ABSTRACT

The report gives an account of the needs of the speech impaired for technical aids, and presents a draft of a proposed research and development program coordinated by the Swedish Institute for the Handicapped in collaboration with the International Commission on Technical Aids, Housing and Transportation. The development of communication skills is briefly discussed, and a description of speech impairment categories is presented along with a brief overview of speech rehabilitation in Sweden. The incidence of the various speech disorders in Sweden are reviewed, and the need for further research and development on communication aid is cited. The need of the speech impaired for technical aids is discussed, including training aids, communication aids, aids to natural speech, alternative means of communication, remote communication, and the special needs of mentally retarded speech impaired persons. Some factors to be taken into account in conjunction with introducing, distributing, and handling aids for the speech impaired are considered. The role of technical aids in the rehabilitation and habilitation of persons with speech, language, and voice disorders is discussed. A proposed research and development program for technical aids designed for the speech impaired is described, and the literature on the subject is reviewed along with the latest technological developments in such areas as the following: amplifiers for persons with weak voices; voice generators; aids for persons lacking the faculty of speech and language development; aids to communication using pictures, symbols, or words; writing equipment; aids to schoolwork; aids in the work environment; aids for the mentally retarded; and alternative means of expression. Resources needed to implement the programs are discussed. A list of proposed projects is presented, including needs surveys, research and development, and testing of equipment and aids. A research review is also included. (DLS)

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Technical aids for the speech-impaired—

Proposal for research and development activities

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Preface

This report constitutes the second publication from the project "Technical aids for the speech-impaired – internationally coordinated development work", which is presently run by the Swedish Institute for the Handicapped with financial support from the Swedish Board for Technical Development. The first report, entitled "Technical aids for the speech-impaired. An international survey on research and development projects" was published in March, 1978.

This publication gives an account of the needs of the speech-impaired in terms of aids and constitutes a draft of a research and development programme based mainly on the actual situation in Sweden.

A detailed account of how the material has been assembled (literature searches, questionnaire, seminars etc) is given in the report.

It should be pointed out that this report was drafted following discussions with members of the reference group, which was formed for the implementation of this project (see Appendix IV). The contents of Section 3.2 "Speech, language and voice disorders" is based largely on material assembled by Professor Björn Fritzell and Logopedist Britta Hammarberg of the Huddinge University Hospital. Some parts of the material in Chapter 7 are based on a working memorandum drafted by Professor Gunnar Fant of the Department of Speech Communication of the Royal Institute of Technology, Stockholm, and on material produced by Dr Gösta Lagermalm of the Swedish Board for Technical Development. Professor Olle Höök, Institute of Rehabilitation Medicine at the University of Gothenburg has contributed with many valuable ideas. Much of the proposal is based on written material presented at the series of seminars on the project held in the spring of 1977 by Chris Hagen, Ph.D., Chief of Communicative Disorders Service, Rancho Los Amigos Hospital, Downey, California, USA, and by Deberah Harris and Gregg Vanderheiden, Directors, Trace Research and Development Center for the Severely Communicatively Handicapped, University of Wisconsin, Madison, Wisconsin, USA.

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1. Introduction

1.1 Background

The spoken word constitutes the primary mode of communication between human beings. Those who are unable to speak or cannot make themselves understood adequately are also handicapped in their ability to communicate personal attitudes and traits and establish satisfactory social relations. In many cases speech therapy offers a solution to the problems of such individuals while in some cases technical aids provide prerequisites for a workable system of communication.

Speech-impaired*) persons form an extremely heterogeneous but relatively small group of handicapped individuals in Sweden. The range of technical aids available to help them compensate for their handicap is small. A consequence of the relatively small size of this group is that unlike other larger handicap groups they have not been able to act as a pressure group. The very nature of the handicap also means that these individuals have difficulties in formulating their specific communicative needs.

To provide the speech-impaired with adequate aids presents many problems related to the divergency of the handicap. There are needs for both simple and relatively complicated aids. A basic requirement is an adequate analysis of the needs of the handicapped person taking into account linguistic, psychological and pedagogical factors in addition to technical considerations. Such insight has to develop successively by pilot studies and evaluations.

1.2 International co-operation in the field of aids for the speech-impaired

We know that technical aids for the speech-impaired have been developed in various parts of the world, often in the form of custom-built aids for individual persons. There has, however, been no common pool of information on these aids and their use and this in itself has constituted an obstacle to the further development and production of aids for a category of handicap represented by a fairly small group of people in each individual country.

These considerations led the Swedish Institute for the Handicapped to engage, in collaboration with the International Commission on Technical Aids, Housing and Transportation (ICTA), on the project, "Technical aids for the speech-impaired - internationally coordinated development work" in 1975 following an initiative taken by the Swedish Board for Technical Development. The Swedish Board for Technical Development had previously in a planning report concerning technical aids for the handicapped suggested that an international group should be created for co-operation in a suitable field. The project has been in progress for three years and funds for its implementation have been granted by the Swedish Board for Technical Development.

The objective of the work was to draft a research program on technical aids for the speech-impaired and to investigate the scope for international co-operation in certain aspects of the field.

A further aim was to compile and disseminate information on research and development taking place in different parts of the world and also to provide information on existing technical aids.

It is hoped that collaboration among different groups in various countries will increase the scope of development, manufacture and marketing of much-needed technical aids for a group which has long been neglected.

Work on the project has included an international survey involving a questionnaire on current research and development in this sphere, and a literature search for references to aids for the speech-impaired (see Appendix II).

Study visits were made to various institutions for the rehabilitation/habilitation of persons suffering from language or speech impairment and to companies and institutions engaged in development work in this field. This was done to obtain a basis for discussions of the need for developing technical aids. Discussions connected with international co-operation also took place in conjunction with a series of seminars arranged by the Swedish Institute for the Handicapped in the spring of 1977.

A Swedish steering committee was formed for the implementation of the project. This committee includes representatives of various specialities, e.g. phoniatrics, rehabilitation, habilitation, speech transmission and technology (see Appendix IV).

*) The term "speech-impaired" is employed in this project in a broad sense to cover all types of language, speech and voice disorders where a technical aid might conceivably solve the entire problem or reduce the effect of the handicap.

2. Development of communication skills

2.1 Communication

Communication requires interaction between at least two individuals. In the traditional model the terms "sender" and "receiver" are commonly used. Both sender and receiver are required to handle ideas and concepts in symbol form. These language symbols expressed by speech, writing or special signals are to be combined into a message according to some system, e.g. a code which is known to both the sender and the receiver. A suitable transmission medium is needed for an effective presentation of the message units. In general, speech communication is not only a matter of oral presentation. We rely on an acoustic as well as a visual medium. A part of the visual communication conveyed by bodily expressions adds to the extra-linguistic aspects of the spoken message. A reduced or distorted bodily mode of expression may be the sole communication medium available to some handicapped people.

Communication is generally interactive, the receiver will respond to the message by expressions of acceptance, questioning, rejection, alertness etc adding to his verbal response which causes the speaker to modify his further presentation etc.

2.1.1 Normal language development

In normal development, the handling of symbols and language usage develops as a natural result of the individual's maturational process and through the child's interaction with its physical and social environment.

The development of language in the infant is highly dependent upon the verbal stimulus it receives from persons around it as well as upon emotional and psychological factors. The child needs a "language model" to imitate and encouragement when attempting to communicate (Bateson, 1975; Seitz and Marcus, 1976).

In early infancy, the child utilizes differentiated crying as a signal system to indicate its immediate needs and wants (Kaplan and Kaplan, 1971).

As soon as the necessary perceptive, fine-motor and gross-motor skills have developed, the child starts to differentiate its play with vocalized sounds and to produce meaningful speech sounds, to be followed

later by entire words. This period usually falls between the eighth and eighteenth months of life. By then the child may be said to possess all of the components necessary for its initial speech communication system (Vanderheiden and Harris Vanderheiden, 1977).

The child learns to synthesize new messages from the component parts of symbols presented to it previously, at first in the form of simple, one-word utterances, later, as its skills improve in the form of more and more complex strings of ideas. The child then gradually learns to form multi-word sentences. This process is also very much dependent on the active encouragement and interest of those around it in providing it with information and language stimulus. The child's own spontaneous exploration of its environment is also considered to be of fundamental significance to the development of ideas and language skill. The processes of maturing and gaining experience interact and provide the foundations for the child's acquisition of language (Sanders, 1976).

Current linguistic research seems to indicate that there is an optimal learning period for acquisition of a first language which is believed to end around puberty. Language learning after that point may employ processes which are less efficient than those used by a child (Krashen, 1975).

The act of verbal communication is thus the end product of the neurologically mediated, integrated and controlled processes of perception, cognition, language formulation, sensory-motor patterning and fine-motor movement (Hagen, 1977). The exact function of each and every one of these processes and their relationship to communication ability in the individual has not yet been fully explored or understood to the point where comprehensive and adequate help can be given in each individual case of communication breakdown, as for instance in the case of the speech-impaired. Much remains to be done in the fields of basic and applied research on the acquisition of language and ability to communicate as this relates to the problems of the speech handicapped (Menyuk, 1975).

2.1.2 Human speech

The final link in the human speech production process, i.e. the element which constitutes the acoustically perceptible result of a person's intention to utter an idea may be said to depend upon at least five factors:

1. Access to sufficient air for breathing

The speaker must be able to control the amount of air, as well as the speed with which the air is expelled, cf. the expression "breath support" used by professional speakers and singers. A person whose faculties are impaired as a consequence of cerebral palsy may, for instance, experience physiological difficulties in this respect in that he lacks the means of coordinating the work of the respiratory muscles and the flow of speech, or at any rate is not entirely able to do so. This will cause his speech to be jerky, to fluctuate in volume or to sometimes become inaudible when air is not present at the right place or in the right sequence. A person must be able to distinguish between normal breathing and the breathing for adequate speech production.

2. Access to a voice source

In normal speech the vocal cords are caused to vibrate by the exhaled air and their opening-closing modulation of the airstream through the larynx constitutes the source of voiced sounds.

3. Resonance

Resonance in a more general sense as a voice attribute determines the sonority (intensity) and adds to the personal voice quality. In a physical sense, resonance is a sound-reinforcing effect in the cavity systems of the respiratory pathways and a requirement for the shaping of individual speech sounds. Resonance is functionally related to the efficiency and proper function of the vocal cords to reach complete abduction within a vocal cycle and to the ability of the velum to close in non-nasal sounds. Many speech-impaired persons lack these requirements, the result being for instance a lack of sonority of the voice or a nasal quality in phonemes which are not intended to be nasal.

4. Speech articulation

Speech consists of a sequence of elements (phonemes, syllables, words) which are intended to carry the meaning of what a person wishes to say. In speech these units are coded by continuous time-varying movements of the articulators (tongue, jaw, lips, velum, larynx etc) and corresponding time-varying configurations and states of the overall source-resonator system. Traditional speech therapy concentrates on the peripheral aspects of speech articulation, which may be disturbed due to improper control and innervation mechanisms whilst the linguistic conceptual mechanisms are intact (dysarthria).

5. Overall coordination

It is essential to have overall control of the sequential patterning of breathing, sound sources, articulations and intonation in order to ensure a correct timing. It is assumed that this coordination is mediated by a number of control mechanisms such as auditive and kinesthetic feedback. This involves highly integrated functions of the central nervous system. Examples of disorders of these functions are stuttering and speech produced by some individuals with dysarthria.

2.1.3 Automatic and voluntary control of speech

Most of the mechanisms referred to above are used by the normal speaker more or less unconsciously. The process is automatic. It is important to remember when discussing the problems of the speech-impaired that much of what is aimed at in traditional treatment and even in applying the technical aids developed to date emphasizes the element of will-power involved, i.e. people must learn a breathing technique, place the emphasis at the correct point in phrases, acquire a new voice quality, use a mirror to see what shape the lips must assume to produce a certain sound, press a button for each phrase when using an artificial larynx and so on. It is assumed that speech therapy makes a person conscious of these elements and teaches him to use will-power to control mechanisms which previously functioned automatically. When the use of a technical aid is recommended as a therapeutic measure to compensate for speech impairment, it is assumed that the person in question will make use of voluntary functions, e.g. resort to written messages instead of audible speech.

3. Description of speech impairment categories

3.1 Definition

Used in its narrow sense the term **speech-impaired** refers to a person whose speech organs have suffered damage, either organic damage to the peripheral voice and speech organs or damage to the parts of the nervous system which are involved in articulation.

However, the majority of speech, voice and language disorders are not permanent nor therapy-resistant. Speech therapy may lead to recovery of normal speech faculties or the development of a new faculty. In some cases, surgery may totally eliminate the handicap, e.g. with certain defects of the palate. The processes of maturing and healing are also factors which remove or reduce speech handicaps.

It must also be borne in mind that there is a whole range of different degrees of impairment and that in less serious cases it is difficult to draw a clear line of demarcation between impaired and "normal" speech, in that the latter may vary a great deal and is difficult to define in precise terms. Furthermore, speech impairment is often accompanied by other handicaps, such as perceptual disorders and disorders of language development. This holds true especially in the case of children with brain injuries.

The term "speech-impaired" is used in the present study in a broader sense to cover all types of speech, language and voice disorders.

3.2 Speech, language and voice disorders

Language disorders

Retarded speech and language development – Disorders in children's development of speech and language skills. There are many different known causes, e.g. impaired hearing or deafness, brain injury (sometimes accompanied by mental retardation, cerebral palsy or epilepsy), mental illness. However, the cause is often unknown.

Aphasia – A disorder affecting the ability to understand or generate language due to brain injury in persons who have previously had fully developed language skills. The most common causes are brain injury as a result of a cerebral infarction or an accident. Speech training for these people concentrates primarily on reactivating skills which they have possessed earlier and which have been affected by the injury.

Speech disorders

Defects of articulation – The most common and least serious form of speech disorder. Such defects are found in 30 % of all children starting school. Usually the defect takes the form of a lisp, but difficulties are also observed in the pronounciation of r-, c- and s-sounds. Most articulation errors disappear spontaneously, or are eliminated by training during childhood. Speech problems following a glossectomy are also classified as articulation defects.

Dysarthria – Articulatory dysfunction caused by damage or disease of the nervous system. Here it is a matter of permanent changes occuring before or during birth or later in life because of disease or trauma. If the patient cannot speak at all, the term **anarthria** is used.

Patients with dysarthria and anarthria constitute one of the main groups in the focus of interest of this project.

Speech disorders which manifest themselves in the form of an abnormal nasal quality are classified under the heading "Nasality". **Hyponasality** occurs in the absence of or in the case of a reduced nasal passage. **Hypernasality** occurs when there is difficulty in executing proper closure of the velo-pharyngeal passage between the throat and the nasal cavities, with the result that the speech has a disturbing nasal quality. In serious cases, the ability to articulate may be gravely impaired. The most common cause is a cleft palate. However, the disorder may also arise as a result of damage to the nervous system and be one of the elements of dysarthria. Surgery is the usual form of treatment, although special aids in the form of obturators (cleft palate appliances) may be prescribed.

Stuttering – A disorder of the rhythm of speech, occurring intermittently. The causes of stuttering are not known, although there are many theories. It is most prevalent during childhood, and in most cases it disappears during growth. In those individuals who do not develop fluent speech, stuttering may become a serious handicap. A great variety of methods to treat stuttering have been proposed, but today, in most centers, the prevailing treatment is psychotherapy and behavior therapy, individually and in groups. Various kinds of technical aids have been tried out and used, but only to a limited extent.

Voice disorders

These may be **organic** in origin, caused by diseases of the larynx, such as inflammations, tumours and paralyses. In the case of advanced cancer of the larynx, the larynx itself has to be removed – laryngectomy – and the patient looses his voice completely. He is in need of a new voice source. In some other disorders like recurrent nerve palsy, the voice may be very weak and need amplification.

Voice disorders may also be **functional** in origin, and these dysfunctions may be labelled phonasthenia, psychogenic dysphonia, nodules of the vocal folds, etc.

3.3 Speech rehabilitation in Sweden

In Sweden as in other countries speech, language and voice rehabilitation employs teamwork. Phoniatricians, logopedists, speech therapists, social workers, teachers, psychologists, physiotherapists, occupational therapists and other medical personnel are some of the categories of professions which may be called in at different stages of a person's rehabilitation. The help of consultants is also sought, e.g. engineers and manufacturers, when discussing different solutions in connection with technical aids. Diagnosis and treatment of different forms of speech disorder take place at hospital departments of phoniatrics, at regional general hospitals, at some ear, nose and throat departments, at logopedic clinics and in schools in connection with speech therapy programs.

3.4 Incidence of different forms of speech, language and voice disorders

3.4.1 Incidence statistics and need for aids

The few studies published to date on the occurrence of different types of speech disorders give little indication of the need of each individual speech-impaired person for a specific technical aid. Even if it were possible to estimate the number of speech-impaired persons, the fact would still remain that too little is known about individual problems of adjustment, psychological acceptance of technical aids, choice of alternative means of communication etc. This in its turn means that any estimate of the number of speech – impaired persons should not be considered to represent or be identical to the number of persons who might derive help from technical aids in solving their communication problems.

To be able to provide an accurate estimate of the number of persons (on an international scale) who might benefit from technical aids for speech, language and voice functions, we must first be able to adopt internationally viable definitions of the different types of diagnosis which exist in this field. Some attempts have been made to establish a common nomenclature, but studies published to date are not based on any internationally accepted system.

The studies reported have, as a rule, been based on estimates of the size of the population in relation to another form of symptomology. Estimates have been arrived at for larger geographical areas by measuring incidence in a smaller area and then drawing conclusions from the results as to the situation in the larger area. With the aid of general knowledge of population trends, sex distribution and average life span it is possible to estimate the number of persons who may need help with rehabilitation of communication following strokes, injury in road accidents, hereditary diseases etc. But here again it is a case of assumption in the light of what is known about rehabilitation needs today.

3.4.2 Incidence of different speech disorders

The following will give a brief review of the incidence of different forms of speech impairment. It should be borne in mind that the studies from which the figures given are derived have been conducted under varying conditions and with many different points of departure in dealing with the issues at stake. In some cases, only a summary definition is given of the various speech disorders, thus rendering assessment of the reliability of the figures difficult.

It should also be remembered that the diagnostic categories listed below (i.e. the categories of speech impairment) overlap to a certain extent as regards the effect of the impairment in individual cases. It is for instance possible for one and the same person to have communication problems as a result of mental handicap, a defect of the palate, retarded speech and language development and a tendency to stutter etc.

Speech, language and voice disorders among the mentally retarded

The communication problems of the mentally handicapped are related to the degree of mental retardation. The following relationships are assumed in the case of language difficulties:

100 % difficulty at an IQ of below 20
90 % difficulty at an IQ of 21 – 50
45 % difficulty at an IQ of over 50
(Spreen, 1965)

Approximately 1 % of the Swedish population is estimated to suffer from some form of mental retardation. Some 35 000 persons receive care and treatment through the public health services in accordance with the law covering that sector (Official Government Surveys SOU 1976:20).

Retarded speech and language development

3–4 % of all Swedish children in the 6-year age group are considered to be in need of individual speech and language training (Hammarberg et al, 1975). The same survey report states that approximately 1–2 % of 4-yearolds are in need of special language stimulus. The figures given do not include immigrant children.

Slightly over 5 000 7-yearolds were screened for speech disorders and of these 58 % exhibited speech skills free from defects. A further 30 % had pronounciation defects (mainly lisps). One year later, a follow-up study was conducted of the children who had exhibited speech defects and it was found that there had been a striking improvement. 1/3 of the children who had earlier had a lisp had now corrected their s-sounds and other disorders had disappeared in well over half of the cases (Almstam-Malcus et al, 1976).

Palatal disorders

It has been estimated that 1/700 surviving births manifests some type of lip, jaw or cleft palate defect (Henrikson 1971). Moreover, the figure is increasing. This category of defect has a very varied effect on speech. Often, both surgery, ortodontic treatment and speech therapy are needed.

Cerebral palsy and speech problems

Approximately 1.5 in every 1 000 children born in Sweden is cerebral palsied. The figure given for certain parts of the UK is 4–8 out of every 1 000 births (Fällström et al, 1976). It has been estimated that 3/4 of all cerebral palsied children need speech and language therapy (Bille, Hagberg, 1975).

A nation-wide survey in Sweden involving 482 pupils in classes designed for children with motor disorders revealed through replies received to a questionnaire sent out to teachers that 285 of the pupils could speak without difficulty, 116 with some difficulty and 81 not at all (Breiditis, Landström, Norlin, 1976).

Aphasia

A survey conducted in Gothenburg in 1962 revealed that each year 60 out of every 100 000 inhabitants developed aphasia as one among, as a rule, several symptoms (Broman, 1971). Practical experience has shown that half of the persons each year who develop cerebrovascular insults etc need speech and language rehabilitation (diagnosis, advice, therapy etc) (Bjuggren).

Stuttering

Stuttering in adults is found in 0,7–1 % of the normal population (Young, 1975). Children in the age group 3–4 often go through a stage of what is referred to as physiological stuttering or reiteration, a condition which should be distinguished from a fully developed stuttering syndrome (secondary stuttering). Only 1/5 of the children who experience problems in maintaining a smooth flow of speech at this stage in their life continue to have difficulties later (Sheehan, 1970).

Voice disorders including speech problems following laryngectomy

A large number of people with voice disorders are treated each year at phoniatric clinics in Sweden. A relatively small number of these receive speech therapy after laryngectomy. At a clinic in Stockholm in 1976, 8 new laryngectomy cases were examined out of a total of 889 voice patients. It is estimated that about 30–50 new laryngectomees will be added each year. At present, Sweden has a total of around 500 laryngectomees. The overwhelming majority of voice disorders treated with the aid of, for instance, voice exercises are found in persons with different organic or functional voice defects, e.g. vocal nodules, paralyses, phonastheria, inflammations etc.

General surveys

Examining the incidence of communication disorders in the USA, it has been estimated that over 16 million adult Americans have such serious communication problems that special measures are required (NIH 1970).

A survey was conducted in the Netherlands in 1971–1972, the aim of which was to compile data on the number of physically handicapped persons in the population, the type of handicap involved, degree of severity and cause. An attempt was also made to obtain an idea of the social circumstances of these handicapped persons and the extent to which they made use of community services available to them. The aim of the project was to study the incidence of different functional impairments in the population, e.g. motor

disorders, impairment of vision or hearing, speech and language disorders etc. The survey covered 4793 persons. Of these, 196 were found to have speech problems. 15 (8 %) could not speak at all, 149 (76 %) could speak but could only be understood with difficulty by persons other than their immediate family, while 32 (16 %) could speak with difficulty, but only in group situations. Thanks to the survey it was possible to make an estimate of the total number of speech-impaired persons in the Netherlands, the figure arrived at being 0,4 % of the population (Netherlands Central Bureau of Statistics, 1976). Children below five years of age and persons with a physical **and** a psychological handicap were not included in the study.

3.4.3 Need for incidence studies in research and development work on communication aids

There is an apparent need for incidence studies to support research and development work on technical aids for the speech-impaired. The importance of conducting studies designed to survey the population from different standpoints should be emphasized. Information is needed on the etiology, incidence and consequences of different speech disorders from the point of view of the individual sufferer in all communication situations. A correct estimate of the number of cases making up each disorder category is also important for planning purposes and for decisions which must be made by individual organizations and manufacturers which develop and market aids.

4. Need of technical aids for the speech-impaired

4.1 Problems

"The basic purpose of communication is to transmit one's needs, wants, feelings and thoughts to another person. Through communication we are able to make ourselves known to others and, thereby, maintain both human dignity and some degree of control over our environment. In a sense, communication is our primary means of establishing feelings of identity and self-esteem. Within this context the goal of treating a communication disorder is that of helping the individual attain a means by which he can be known to others." (Hagen, 1977)

In some cases, a technical aid, correctly applied, can constitute an adequate replacement or compensation for loss or impairment of specific communication mechanisms. In applying a technical aid to a case of speech impairment, it is important to choose a system which resembles a natural mode of communication as far as possible.

In discussing the need for aids designed for the speech-impaired, it is important to realize that the user groups, the aids available, and the purposes of these aids are all extremely heterogeneous.

A distinction should be made between aids intended to **compensate** for or to **replace** a **lost function** and aids designed to **develop** and **generate** a function which the speech-impaired person did not previously possess. Thus, a technical aid for an adult with insufficient voice intensity is primarily designed for compensation whilst specialized play-materials for a physically disabled child are designed to stimulate language development and the will to communicate.

4.2 Different types of aids for the speech-impaired

The list below illustrates the vast variation in types of aids of a technical nature designed for the speech-impaired.

A. Aids for training

I. Aids for stimulating the development of a hitherto undeveloped or underdeveloped function

a. Aids which stimulate the motivation to communicate and develop the **function of language** in children (e.g. various toys, games)

b. Aids which further **language recovery** in adults, e.g. persons suffering from aphasia

c. Aids which stimulate existing speech faculties and train the **speech function**

B. Communication aids

I. Aids to **facilitate communication via a person's own speech function**

a. Aids to compensate for reduction/disappearance of a function (e.g. artificial larynx for laryngectomees)

b. Aids which assist a person's own speech organs in certain situations (e.g. speech amplifier)

II. Aids **which substitute a person's own speech function** (e.g. symbol charts, writing appliances, aids involving synthetic speech). The use of these aids should not prevent the person from using his own speech in situations where this has a communicative function.

4.3 Requirements and fundamental considerations for the use of technical aids

Very little is known about what actually needs to be done to satisfy the requirements of the speech-impaired for technical aids. Separate studies of the problems of providing aids for speech-impaired persons have only been conducted on a small scale and refer solely to certain specific groups of disorders. A survey of the need for aids represented by persons whose speech disorder is of neurological origin has recently been started in Sweden. However, in the light of the material at present available one can only hazard a guess as to the areas in which a need exists without pretending to have covered the total need in that area. Further analyses of needs will have to be carried out as new results referring to previously uncharted areas emerge.

A technical aid for a speech-impaired person should primarily be evaluated from the point of view of function (Hagen 1977). The medium as such is of subordinate significance in this context.

4.3.1 The aid must correspond to the person's (the speech-impaired person's and receiver's) ability and needs

4.3.1 a) Linguistic/cognitive/intellectual

It is particularly important when planning the application of a technical aid to ensure that it corresponds to the potential user's intellectual and cognitive abilities at the time of application. For instance it must be ensured that an aid is not prescribed which uses symbol systems requiring a higher degree of skill than that possessed by the patient. The symtoms of speech impairment may change as a result of treatment i.e. there may occur a spontaneous healing and adjustment of the person to his reduced ability to communicate etc. It is also necessary to assess the person's improved skill in handling aids. On the other hand, an aid should not be so difficult to handle that the speech-impaired person is constantly in a learning situation when trying to use it.

4.3.1 b) Emotional/motivational

Some speech-impaired persons try to achieve the most advanced level of communication possible to them. On the other hand some speech-impaired individuals choose a level for communication with their environment that is unduly low. The reason may be absence of motivation (insufficient encouragement on the part of those around them, no-one with whom to communicate and thus lack of opportunity for practice etc.). Some speech-impaired persons prefer to communicate at a fairly simple level and find no use for more advanced equipment offering greater scope for expression.

A given individual may have varying scope for expressing himself and compensating for his speech handicap in different situations. Persons suffering from aphasia for instance, may perhaps manage fairly well in familiar surroundings among people they know and who know them, i.e. know about and accept the speech handicap and adapt their listening and reception mechanisms accordingly. However, it is common for persons with a certain type of aphasia, particularly those who are aware of their speech handicap and who notice their "language mistakes" etc, to experience anxiety in the face of communication situations involving persons unknown to them or in situations when many persons are present at the same time and where there is more pressure on the ability to communicate, and to make themselves heard.

These people have a built-in barrier to communication in any other than very limited contexts. There are, for instance, persons who only express themselves when a close relative or therapist is present and who do not attempt to communicate when several persons are in the room. It is also known that these people can operate on a much more advanced linguistic expressive level in situations with which they are familiar than in other instances. The ability to use speech and to express themselves is becoming more limited in the latter case.

One can conceive of a multitude of situations where these people would need to compensate for their difficulties with a technical aid, while in other situations they manage quite well with their own speech function, though perhaps with a certain measure of difficulty.

4.3.1 c) A speech-impaired person's ability to use different control devices

In choosing aids, critical factors may prove to be the degree of precision in movements needed to operate the input unit and the latent skill required for this operation. It must be possible to evaluate a person's potential for handling different control devices by diagnosing the difficulties arising in each individual case. Often there will have to be a compromise between what a person can manage cognitively and intellectually speaking and what is feasible in the light of his motor abilities. This is a technical problem to which there could be a number of different solutions which will permit this gap to be bridged. If a person has the intellectual potential for rapid communication, weakened muscles, for instance, should not slow down the flow of messages. Instead, an effort should be made to provide controls which do not involve the impaired function, but which use other mechanisms (cf. eye movements). Here again, it is conceivable that one and the same person may use a **number** of systems and technical solutions offering, different degrees of rapidity for different types of situations, listeners and so on.

4.3.1 d) Acceptance of aids

No detailed studies have yet been made of speech-impaired persons' acceptance of a technical aid and receivers'/listeners' acceptance of that aid. As far as the user is concerned, one can envisage questions arising in connection with the fact that a technical aid must be regarded as a sort of prothesis. We know from having studied other groups which use artificial limbs and appliances that such aids are accepted to most varying degrees by their users. An important point is to be able to incorporate the appliance/aid into the person's own body image. In the case of the speech-impaired, a parallel could be drawn in saying that the person concerned must learn to regard the speech aid as a replacement for a lost function and be able to accept it in this capacity. To achieve this, the aid must truly correspond to the requirements which the person may make of it.

A person's image of himself in relation to other persons and phenomena in his surroundings is shaped through communication with his environment. A feeling of self-esteem can be developed. On the other hand, a person who confronts another with silence is regarded, for instance, as sinister, dangerous and gives those around him a feeling of uncertainty. The receiver's image of the transmitter is firmly based on the fact that **the person speaks** and on the **contents of the communication** and on the **outward contingencies of the communication** (emotional state, tone of voice etc.). It can also result in less inclination on the part of those in the environment to communicate with the speech-impaired person since the latter's reactions are not those expected (e.g. a reaction of silence instead of response).

The ability to use one's own speech faculties is probably of vital importance to personal perception of identity. It thus follows that the emphasis should be placed on producing aids which support the speech organs, even if this is a means of communication which only works in a certain situation or as a complement to non-vocal communication.

An important factor which is probably of decisive significance to the receiver's acceptance is the speed of the communication process. A person who takes a very long time in communicating and who in addition misses the target in operating the controls with the result that the code does not emerge clearly obviously has much worse prospects of effective communication. Effective communication requires a certain speed in order to be accepted by the receiver. If a message takes too long a time to emerge, the listener tires and the chain of communication is broken.

4.4 Need for training aids

A need can be foreseen for a series of aids designed to stimulate and develop an underdeveloped or undeveloped ability to communicate. Children need training in language skill and conceptual development plus stimulation to speak. Persons suffering from aphasia need aids which stimulate recovery of language.

In the case of children, equipment is needed which is adapted to each step in language/communicative development as we assume this functions at present. We know that a person's interest in expressing himself is largely dependent upon the stimulus and encouragement for social exchange which he receives as a child, and indeed as far back as early infancy and the toddler period (see earlier chapter on normal speech development). If a child does not seek to communicate or respond in communicative situations, a rupture occurs in the development of contact and communication processes which it may be difficult or even impossible to repair later on. At a higher level, the child will begin to behave as an individual, to seek contact with persons other than his parents (as a rule, from the age of 8–10 months onward). The child then needs, for instance, to communicate for the purpose of attention, recognition, indication, choice etc. Later on in the development process a need can be foreseen for further language-stimulating play materials (e.g. objects showing cause and effect, logical sequence etc). The child also needs to be able to formulate questions, exclamations, different emotions and so on. When the child finds itself in a group situation, e.g. at nursery school, it needs still more refined means of expression, a larger vocabulary etc. All these functions require training. Later, at school, aids are needed to permit the child to absorb various types of teaching material.

4.5 Need for communication aids

4.5.1 Aids to natural speech

There is a need for a number of different types of aids designed to compensate for impairment or absence of parts of the speech function. In other words, there is a need for various aids to facilitate spoken communication in the absence, for instance, of a sound source. The aids available for such people today need to be improved. Aids are also needed to facilitate the use of a person's own speech faculties in a noisy environment and in unfamiliar surroundings where the listener is not used to receive messages. This means that there is also a need for special telephone sets with increased amplification.

Appliances capable of modifying a dysarthric condition or pronounciation difficulties with a neurological background also need to be developed, since the aim after all is to achieve a means of communication which makes use of the speech function insofar as this is possible.

4.5.2 Alternative means of communication (alternatives to natural speech or used as a complement to this)

Work on the project and examination of published material on this subject has spotlighted the fact that there is a particular need for a number of aids which are not based on the use of natural speech. This holds true in particular in the case of speech-impaired persons with little scope for using their speech organs as a source of communication due to the nature of their handicap. Portable systems are needed which can be carried around by the individual user. The system must also be suitable for fitting onto, for example, a wheelchair. In some cases, stationary systems are needed, e.g. in classrooms, at work, for the bed-ridden etc. Systems developed must permit communication in a multitude of different real-life-situations, e.g. signalling in the presence of danger, communication for purposes of nutrition, dressing, time spent in different rooms and similar ADL activities. It must also be possible for the person to maintain a large number of social contacts in the immediate environment and perhaps also in a broader context in society at large, at work, while travelling, in leisure-time activities etc.

There is a need for simple signalling devices to permit transmission of messages in cases of danger when it is absolutely essential to attract attention etc. and when it is not possible to rely entirely on the impaired speech function. At a more advanced level, appliances should also be developed as a support for existing speech faculties and which would help to clarify elements which do not emerge clearly, e.g. mechanical writing devices which produce parts of a message in more than one form of code (spoken and written).

We also need more advanced systems for correction of syntactical deficiencies in messages and comparison with the norm so that the messages can be accepted and decoded by the receiver.

An effort should, however, be made to develop systems which permit simultaneous use of an aid along with what is left of the person's own speech and ability to express himself, e.g. voice function, since this helps to create a more natural impression of the person as a communicating being. It may be assumed that the further removed a system is in acoustic terms from natural speech, the more difficult it will be for the listener/receiver in particular to accept it.

There would appear to be scope for making appliances which produce life-like synthetic speech (speech synthesis) and which would satisfy need in persons who cannot use their own voice for communication purposes. Special attention should be paid to the requirements of the speech-impaired for individualization of messages in respect of, for instance, intonation, shades of meaning, tone and emphasis.

People suffering from aphasia may have difficulty in understanding language or in expressing themselves (spoken and written means of expression, use of the hand for e.g. pointing) or may suffer difficulties in both spheres. Aphasia is often accompanied by memory defects and perceptual difficulties of an auditive, visual and tactile/kenesthetic nature which should be taken into account when developing aids and adapting them to the needs of the individual patient. Today aids are primarily developed for persons who can understand language and use it, though not as a clear means of expression, i.e. need help with the output aspect of communication. Adaptation of aids to other types of aphasia involving various forms of damage to the central nervous system and to the input mechanisms (comprehension of messages, decoding of messages) would appear to be considerably more difficult, as this requires manipulation of the central processing unit, in this instance the linguistic competence of the person.

4.5.3 Need for remote communication

In addition to aids permitting communication with the immediate environment, we predict a growing need for appliances permitting conversations with persons not in the vicinity, i.e. transmission systems akin to the telephone and both with and without transmission of images, visual information. We also foresee a need for aids such as intercom-telephones, which can be used within a given building or institution. The need for video-telecommunications is based, among other things, on the fact that there are people who due to serious motor disorders must go away to school or spend time away from home for treatment etc. The most seriously speech-impaired children, who are cared for in institutions, are in a difficult situation. They are dependent upon communication with their family, but have little use for conventional telephones which cannot transmit the body language and mime which are so essential to them. Many seriously speech-impaired children in this situation have, according to institution staff, developed their own system of communicating with members of the family using what one might describe as a paralanguage, i.e. a system whereby significant elements in the signal do not primarily originate in audible output at pho-

neme and morpheme level, but are instead part of a form of body language, gestures and emotions. The optimum method of transferring paralinguistic phenomena is through a combination of auditive and visual approaches. In fact, other categories of the speech-impaired might find it useful to develop similar systems.

4.5.4 Needs of mentally-retarded, speech-impaired persons

Many of the types of aids for which there is considered to be a need may perhaps also satisfy the requirements of mentally-handicapped, speech-impaired persons in need of help in communicating with others. In some cases instructions for use, controls and design will require adaptation. Further, as it is assumed in the development context that the range of aids should correspond to needs at different stages in the development of symbol interpretation, memory functions, communication needs and so on, it is also understood that consideration should be given to the special requirements of the mentally-retarded. More research must be conducted in this field in order to obtain an adequate range of technical communication aids for this group.

Information must be obtained about the different communication environments in question, the potential of the individual persons etc. There is however, no doubt about one thing – namely that the efforts made in recent times to integrate the mentally-handicapped into the community at large increase the need to be able to communicate in unfamiliar environments, as compared to life in an institution. A better supply of service appartments, residential service and more openings to an active working life will mean that mentally-retarded persons will also need better facilities for using technical communication aids.

5. Factors to be taken into account in conjunction with introduction, distribution and handling of aids for the speech-impaired

It has already been confirmed that the range of technical aids available for the speech-impaired is still very small in Sweden as well as in many other countries. Also, existing aids are not being used at full advantage or prescribed to the extent one might expect. Several causes may be suggested. e.g. a substantial lack of knowledge of the function and correct application of aids.

Despite a great deal of interest in the field, one can also note a certain degree of hesitancy over involving technology in speech therapy which is by and large based on personal interaction. Speech training has commonly been regarded as a process in which one should try to have as little interference from technical devices as possible. Technology has been reserved largely for the diagnostic aspect of work with the speech-impaired (e.g. X-ray apparatus, laryngeal cameras, audiometry).

Another difficulty can be to find the right information on application of aids for the individual speech-impaired person. Catalogues containing information on existing aids may perhaps not be available or there may be difficulties of a purely economic nature involved in obtaining or maintaining aids, if these aids are of the technically advanced type.

In addition, some aids are not acceptable to the user or receiver/listener, for example for cosmetic reasons. The aid may be too large or clumsy to permit easy transportation for use in different communicative situations or again its vocabulary may be too limited. Another point to bear in mind is that some aids are not suitable for certain user groups; they may be complicated to operate, require manipulation of symbols at a level higher than that which can be managed by the user or involve a communication process which is too long for the listener to have the patience to wait for the message to emerge.

Moreover, some existing aids for the speech-impaired lack the requisite technical reliability and fail to fulfill the performance requirements for apparatus used for a purpose such as communication.

5.1 Development of educational programs

It is particularly important when developing more advanced systems for use by the speech-impaired, e.g. systems involving the use of computers, various types of electronic controls etc., to underline the need for developing an educational program for the introduction and application of these systems. Otherwise, there is a risk that the systems will not attract sufficient interest among those who will introduce them to the speech-impaired; and also that a system will not be utilized to the optimum degree to the very limits of its technical capabilities. In some instances, this will probably govern whether a given aid is made use of at all.

There is probably also a need for educational programs covering the use of a wide range of less advanced systems. In principle, every aid should be accompanied by a manual introducing it and giving instructions for use, plus the various ways in which its therapeutic potential can be employed.

5.2 Need for information and training

If it is to be possible to have technical aids for the speech-impaired used in the correct way, information must be provided for those who prescribe them and training courses must be organized for the therapists and teachers who will be helping these people to use the aids in the best way.

A number of other professions also need information and training in this field, i.e. categories of people who may conceivably come into contact with speech-impaired persons who use technical aids for communication (medical personnel, psychologists, social workers, student teachers etc.).

The persons responsible for prescribing aids must be kept up to date on what aids exist plus the prescription instructions applying for them. Regular information on work being done in the field of aids in general is also valuable to this group. Therapy personnel whose job it is to introduce aids to the speech-impaired must also be thoroughly versed in the training instructions, range of aids available and their modes of operation. Some therapists would probably also find it valuable to be given information on the maintenance of aids, i.e. some elementary technical know-how.

6. The role of technical aids in rehabilitation/habilitation of persons with speech, language and voice disorders

The use of technical aids is one of the many approaches to the rehabilitation or habilitation of speech-impaired persons whose ability to communicate is hindered by various disorders. Such disorders are commonly treated by means of speech therapy provided by specially trained persons.

One occasionally notices when discussing the role of technical aids in work with speech-impaired persons that there is a tendency to view the issue as a case of "either/or", i.e. speech therapy versus technical aids.

In some cases, however, it has been noted that, for instance, children with serious speech disorders, who have not previously been able to use their own speech function as a means of expression, have begun to use it to a greater extent after having used various alternative methods of communication for some time, e.g. symbol language, symbol charts. It has also been noted that speech has not been inhibited by the use of such therapy methods, as was previously thought (Vanderheiden, Grilley 1976).

Some of the existing aids for the speech-impaired do not, however, provide the degree of flexibility necessary when a person is improving his communicative skills (in some cases, for example, by spontaneous healing, the process of maturing etc). In fact, there is a risk that apparatuses may retard development rather than promote it.

In many instances, aids need to be prescribed parallel to other forms of speech rehabilitation. It would be particularly unfortunate if we were to abstain from employing current therapy methods as the supply and quality of aids increases.

More work must be done in the field of diagnostic research and therapeutic development work alongside research and development in the field of technical aids in order to improve the overall treatment situation. The aim should be to produce a combination of speech therapy and technical aids which suits the patient. The optimum solution would be an aid which could "grow" with the progress made by the patient in the overall therapy program to supplement and support his/her communication abilities at every stage.

7. Draft research and development programme

7.1 Background

The aim of the project "Technical aids for the speech-impaired – internationally coordinated development work" has been to draft a research and development programme for technical aids designed for speech-impaired persons and to investigate the possibilities for international collaboration in certain fields. A further aim of the project has been to collect information on research and development activities in different parts of the world and to publicize existing aids to give the speech-impaired an opportunity of obtaining them.

Work under the terms of this project has been focused on personal aids, as it was necessary to restrict the scope for practical reasons. However, the need for adequate aids for use in training and treatment cannot be sufficiently emphasized. A number of projects have been proposed for high priority; these concern technical development and evolution of educational methods for speech training and language stimulation. A special program should be established for these needs.

Aids for diagnosis constitute another important field which it was not possible to cover in this project. Development work is nevertheless in progress on apparatus and methods designed to facilitate more reliable diagnosis. Correct diagnosis, detailed assessment of the impediment and the development potential of the individual case are important prerequisites for the choice of a suitable rehabilitation or habilitation programme.

The research and development measures suggested are based on information extracted from literature on this subject and on experience plus qualitative assessment of description of needs observed in the course of field work. They are also

based on assumptions as to how some possible aids could improve things for a speech-impaired person. The draft should therefore be regarded as a basis for discussion, which can be filled out as new research findings emerge, the pattern of needs crystallizes and resources are increased.

It is important that more detailed surveys of the needs of the different diagnosis groups be carried out to ensure a more reliable basis for assessments. It should be pointed out, however, that such surveys naturally cannot be expected to provide information on speech-impaired persons' overall need of aids or other forms of treatment. The problems which should be examined are the consequences of a speech or language disorder for the life and development of the person afflicted and the dilemmas and difficulties experienced by such people in various everyday situations. This approach provides more reliable material for assessment of, for instance, the need for research and development. The draft programme presented in this report advocates a number of these needs/surveys and these may serve as an illustration of the type of studies which may be considered in the future.

Many of the projects proposed should be seen as qualitative studies of needs. It would also be very useful to carry out quantitative analyses of needs in order to receive a notion of the incidence of different types of speech disorders (Project 1:1, see Appendix I).

The importance of making use of the knowledge which speech-impaired persons themselves have regarding their handicaps should be pointed out. To be able to let this kind of knowledge form the basis for planning research and development activities it is of utmost importance to find the means for the necessary cooperation.

The projects proposed are listed in Appendix I and have been subdivided into three groups according to their nature: 1) Survey of needs, 2) Research and development, 3) Testing and evaluation.

Aids for speech-impaired persons should increase the scope for habilitation and rehabilitation. It is therefore of vital importance that these devices should work in concert with a whole series of other measures. Any research and development work will thus also be closely bound up with the need for steps to be taken in adjacent fields or of a more overall nature. This becomes clear the minute we are faced with the necessity of quantifying existing needs, specifying their nature and establishing adequate links with medical or educational prerequisites or trying to design aids from the start which will facilitate as extensive and uncomplicated application as possible.

This R&D programme is therefore not limited to projects of a purely technical nature. In some cases, knowledge of other scientific fields is also necessary, e.g. psychology, education, sociology and medicine. In most instances, it is a case of interdisciplinary efforts.

Examples of projects which largely lie within the psychological sphere are those studies connected with acceptance of aids. It is important that studies be carried out on the attitude of the users and counterparts and on acceptance of different communication aids (Project 2:1).

An example of a project requiring interdisciplinary efforts is Project 1:3, the aim of which is to provide descriptions of persons with speech disorders as a result of neurological damage and to develop better technical aids for that group.

Another example of a project with a marked interdisciplinary slant is the one designed to develop aids and materials for language stimulation of physically disabled children (Project 2:18). Implementation of this project requires collaboration and know-how in the following fields: linguistics, learning and development psychology, neurophysiology, education, technology and so on.

7.1.1 Presentation of the material

The categories of aids considered in this report are divided into two main groups as follows:

- aids which make it possible for persons to communicate using their own faculties of speech
- aids for non-vocal persons.

Categories of aids found in the first group are:

- amplifiers which boost a weak voice
- voice generators
- prostheses for persons with velar insufficiency, laryngectomees and glossectomees
- aids to alleviate stuttering.

Categories of aids found in the second group are:

- aids to development of speech and language
- aids to communication using pictures, symbols or words
- typewriter systems
- aids to communication using synthetic speech
- aids to telecommunication
- aids for use in schools
- aids for use in the work environment.

7.2 Aids making it possible for persons to communicate using their own faculties of speech

The aids which have come to our knowledge and which are grouped primarily under the above heading are designed for persons with weak voices, for laryngectomees, for persons suffering from velar insufficiency and for persons with a stutter.

These aids are largely intended for adults. A survey should be made of children's needs for aids to improve their speech.

7.2.1 Amplifiers for persons with weak voices

Persons with weak voices are, for instance, those suffering from recurrent nerve palsy, laryngectomees and others. Telephone receiver amplifiers and voice amplifiers (Fig. 1) have been developed to assist this group.

A number of amplifiers of varying quality are to be found on the market. Tests of the technical properties and performance characteristics of these have been conducted in Sweden.

A new voice amplifier has been developed in Sweden in an effort to provide for the needs of the handicapped and to meet their requirements in terms of quality.

Further development work is, however, necessary on adaptation of this voice amplifier to various situations which arise in the sphere of working life (e.g. the fact that a taxi driver must be able to talk to passengers and to talk to the switchboard over the radio, project 2:14). More work will also have to be carried out on microphones mounted in the immediate vicinity of the mouth close to the oral opening;

Fig. 1 A speech amplifier can make a weak voice sound louder (Sweden). Illustration from leaflet on laryngectomy, "Laryngektomerad – utan struphuvud", Riksföreningen mot cancer, Stockholm.

Fig. 2 Artificial larynx (Germany). The device replaces a missing function of the vocal folds while the articulation is performed by the speaker in a normal way. Illustration from leaflet on laryngectomy, "Laryngektomerad – utan struphuvud", Riksföreningen mot cancer, Stockholm.

these must satisfy requirements with regard to performance, appearance criteria and durable design (project 2:15).

Knowing the difficulties which the group of people in question experience in returning to a full working life after suffering speech impairment, we feel that a project dealing with the problems of these speech-impaired persons in terms of communication in the working environment will be valuable (project 1:2).

7.2.2 Voice generators

Laryngectomees receive oesophageal speech training following their operation and it is usually claimed that 60 – 80 % of all laryngectomees develop a viable standard of oesophageal speech (Bergström & Stendahl, 1973). The remainder are totally or partially dependent upon an artificial sound source, a voice generator, for oral communication purposes (Fig. 2). A monograph by Yvan Lebrun 1973 contains a review of aids of this type. A survey of laryngectomees' need for speech aids (Bergström & Stendahl, 1973) revealed that a large number of laryngectomees were not satisfied with their voice generators.

A project currently in progress in Sweden (project 2:16) aims at improving the lifelike qualities of speech produced via an artificial larynx. The vibrator head is mounted against the throat, the pitch being controlled via a hand-held control unit. It is conceivable that pitch may at some future point be controlled by EMG signals and a study of this field has therefore been included in the project.

There is nowadays an obvious need for greater variation in the range of aids available for laryngectomees. Information has been received on a number of aids for laryngectomees which have been developed in various countries. It is considered important that testing of these appliances be carried out (project 3:1).

7.2.3 Prostheses for persons with velar insufficiency, laryngectomees and glossectomees

A speech appliance can be used by persons suffering from velar insufficiency originating in traumatic or congenital damage, e.g. cleft palate, and also in neuromuscular malfunctions in cases where surgery is not considered justified. In some cases a prosthetic speech aid can benefit the laryngectomees by maintaining external pressure on the neck to increase voice volume and minimize air expenditure.

Prostheses have also been utilized with glossectomy patients.

The appliances available today are made to measure for each individual patient.

We have collected a considerable number of references on recently developed appliances, the value of which should be investigated (project 3:2).

Thanks to improved operating techniques, the number of persons with congenital defects using speech appliances is diminishing.

It is possible that further development work in the field may prove necessary, e.g. in the light of the new materials for speech appliances being introduced, but as yet no definition can be given as to the precise needs in this respect.

7.2.4 Aids to alleviate stuttering

It is generally estimated that 0,7–1 % of the adult population stutter. The type of therapy offered is usually a combination of treatment of symtoms and talks with the specialist and/or group therapy. A course of treatment will often involve therapists and stutterers working together in groups.

Certain items of equipment which affect speech rhythm have been developed and used on stutterers in various countries, e.g. metronomes, delayed auditory feedback equipment and auditory masking equipment – aids which in theory at least should be suitaole for personal use.

Literature on the subject has dealt with this type of equipment fairly extensively. It is therefore felt appropriate that these references be compiled and subjected to critical examination with special attention to data on long-term effects (project 3:8).

No aids for personal use are recommended in Sweden for this particular group.

As views differ on the mechanisms at the root of stuttering, methods of treatment and criteria for treatment results, it would appear difficult for the moment to assess the need for aids for this group.

We may more or less expect to witness the emergence of technical aids in the future which work on the principle of biofeedback mechanisms. The use of myoelectric signals transmitted from the throat muscles has been discussed as a possible approach. Systems of this kind might be applicable in cases of stuttering. The method can in principle be resorted to for a number of different speech and voice disorders (project 2:8).

7.3 Aids for persons lacking the faculty of speech

We refer here to aids which make it possible for a person to express himself/herself by means of alternative (non-vocal) means of communication, if that person is unable to communicate by means of speech or if for some reason the use of speech is not advisable.

It is important to bear certain points in mind when discussing aids which act as alternatives to human speech.

The crux of the matter is to be able to provide the handicapped person with aids which reproduce the natural sequence of communication as faithfully as possible when communicating with another person.

The choice of system should be governed by the handicapped person's own ability and the limitations of the person or persons with whom communication is to take place.

A good aid to communication means:

- that a speech-impaired person can communicate independently under all circumstances
- that communication can take place rapidly and efficiently
- that a person's improved motor and language skills can be used to increase the speed and impact of communication
- that the user is encouraged to develop his/her skills.

It follows from the above that one general type of aid can hardly satisfy all these requirements. A series of different appliances will be needed, each one optimized for a given situation.

The aids to alternative means of communication that we know of are seldom versatile. Even if they have progressed from the prototype stage and are available for purchase, it is often difficult to adapt them to the needs of different persons. One reason for this is that they have been designed to comply with the requirements and abilities of a specific user, while another is the lack of standardization. The road from prototype to finished product is a long one and this is why most commercially available products are the results of out-of-date technology with excess weight,

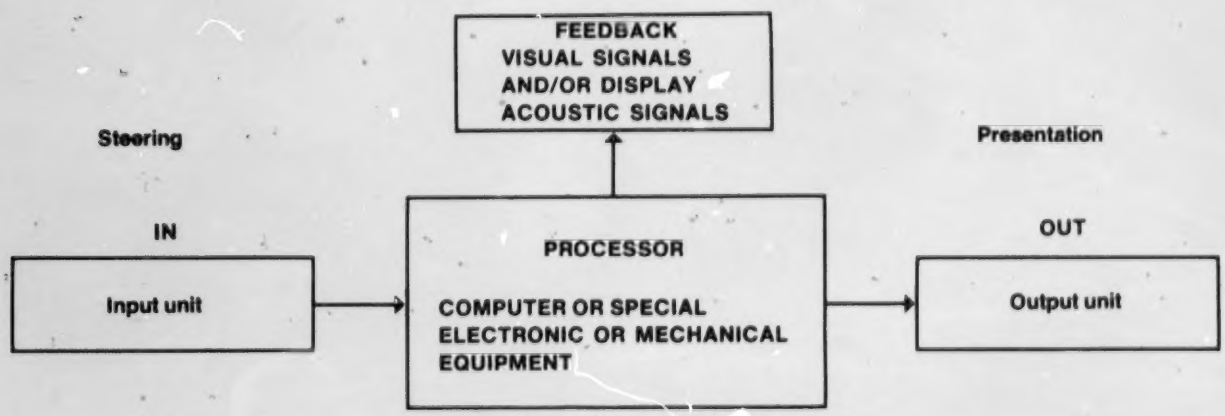


Fig. 3 General blocks of a communication aid.

high power requirements, poor durability and service problems as consequences.

The number of variants in the apparatus program can be kept low if microprocessors are used to a greater extent along with a high level of standardization. The principles of a general type of system are shown in Fig. 3.

The value of the system proposed lies in the fact that it is flexible. Aids to communication can, for instance, be programmed to provide for individual needs in terms of vocabulary, range of symbols and changes in vocabulary.

There is a choice of input methods to ensure the best possible degree of adaptation to individual needs. Programs for interpretation of control signals can be fed in for each variant in input and simple switching is all that is needed to be able to change over to a new type. Relays can be designed in such a way that the type of control mechanism is automatically recognized as soon as it is connected.

Some examples of control principles could be mentioned: electro-mechanical switches, pneumatic switches (suck and blow), switch activated by sound detector or eye-movement etc.

In principle, the central unit should be capable of accepting any means of input. It should be possible to gradually adjust programs for deciphering control signals from custom-made control devices as the user becomes more adept at manipulating the controls. If the user is to be able to derive benefit from his equipment and the person addressed to be able to receive the user's messages, communications must be rapid and efficient. The processor should therefore be designed to store complete words and phrases and it should be possible to program the memory for all types of presentation; e.g. printouts, synthetic speech and so on.

It is possible that one central unit might be able to serve a number of users simultaneously. Let us give an example: A teacher in a class room housing several speech-impaired children with varying types of motor disorders wishes to use a number of different pieces of equipment for teaching purposes, e.g. a printer for printing out the pupils' answers to questions, a display which can be read by all members of the class, a loudspeaker for reproduction of synthetic speech etc. The system should make it possible for each pupil to work individually with any output device and get individual attention. One of the pupils will perhaps be trying to solve a number of problems written out with the help of an electric typewriter, while the rest of the class is discussing some topic of current interest and is transmitting its answers via the display (television screen) so as to make them fully legible for the entire group.

The advantages of mini-computer techniques are that the input and output devices can be custom-made for each person, while the actual workings of the system can be adjusted by reprogramming. A large measure of flexibility is achieved thanks to a wide range of accessories which can be used simultaneously and which via gradual adjustments to programs can be kept in step with the progress made by the user. Intelligent systems which are capable of "growing" and "learning" in step with the user greatly increase the use potential. There have already been interesting applications of this technique in the form of communication aids developed in Denmark and the USA, see Figs 4 and 5.

A further advantage of this technique is that specialists and companies engaged in development work and manufacture can

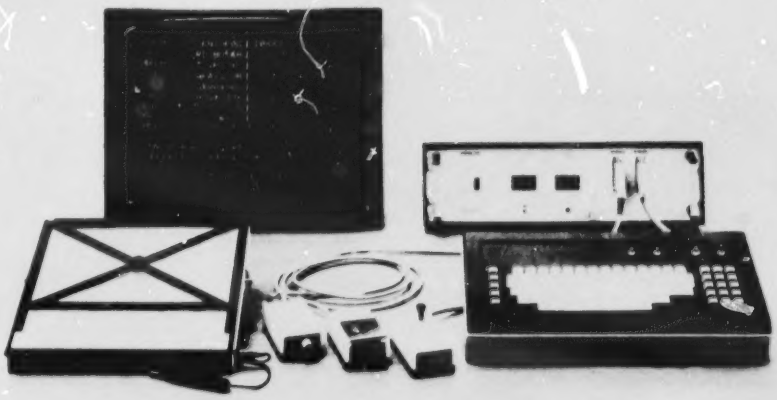


Fig. 4 Vidialog (Denmark). A communication system designed for the educational setting. By using a suitable control device a severely physically handicapped person can move a cursor on the TV-screen to any item in the set of symbols. The selected symbol can then be written on the bottom lines. By using a separate keyboard the teacher can also write on the TV-screen.

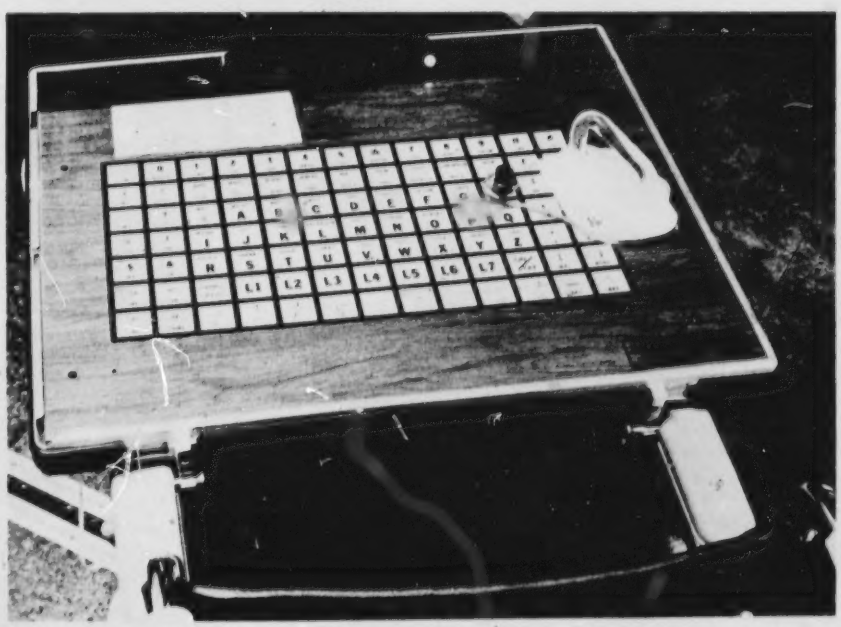


Fig. 5 Autocom (USA). An electronic communication board, mounted on a wheelchair. A letter or word can be selected and written on the light display by a single pointing motion of a magnet on the surface. The text can also be printed on a paper strip by means of a built-in printer. The aid is based on a microprocessor which makes it programmable. The vocabulary as well as the arrangement of the words and letters on the surface of the aid can be selected and changed by the user to meet individual needs.

concentrate on the field in which they are most expert. This in its turn means that the time which elapses between the birth of an idea and the emergence of the finished product can be shortened.

Structuring of production in this way requires advanced standardization. Moreover, work on standardization should take place on an international scale to achieve the required effect.

7.3.1 Aids to speech and language development

Technical aids can assist the aspects of a child's development which are connected with the ability to communicate. It is important that a child should be given the opportunity of communicating effectively with his/her surroundings. Compensation should be provided for sensory handicaps and physical disabilities in such a way as to offer the child the stimuli to explore the surroundings, help shape them, develop and learn through play.

A child can be stimulated to make sounds and to speak with the help of toys which react to sounds (Fig. 6) or to a certain category of sound. Apparatus of this type has been successfully tested on deaf children. A specially adapted range of equipment should also be developed for speech-impaired children in possession of their hearing (project 2:17). The project should also include experiments with amplified feedback.

Project 2:18 is another project which deals with aids designed to stimulate language development in children with serious physical disabilities. The aim is to develop a range of different appliances which can stimulate a child's perception and which contribute to the development of language usage.

Some of the appliances mentioned earlier can be equipped with control units which can even be manipulated by physically disabled children. These children's degree of handicap varies a great deal, but nevertheless it is important that all make optimum use of their motor abilities. This will only be possible if there is access to a range of controls which gradually increase the degree of difficulty and which can be adapted to the motor potential of different parts of the body. Many of the switches already available would fit into a range of this type. One project (project 2:19) has produced a suggestion that a technical study be made of the products on the market, along with an inventory of other control devices already developed and tested, plus documentation of other needs accompanied by sketches indicating how the needs might be met. A standard range of switches for aid centres, toy libraries and nursery schools should be established as a separate project (project 2:20). This project should also solve the problem of standardization of connections between controls and appliances. The work should include initiation of development and production of items which would fill any gaps in the range.

In addition to controls for switching appliances on and off, it is important that even severely physically disabled children should be given a means of continuous control over certain features of their surroundings. There is an urgent need for development of units facilitating proportional control. A project worthy of consideration might be the development of suitable types of transducer (to convert pressure or movement into electrical signals) and to adapt these to different degrees of motor disorder (project 2:21). Several appliances dealt with under the terms of project 2:18 on language and speech stimulation of children with serious physical handicaps should emit continuously variable signals which are fed back and which stimulate the child, e.g. reproduction of sound with means of volume control, speed variation of radio-controlled cars or model car racing track, television games of various kinds, printers where the movements of the pen can be controlled vertically or horizontally by means of two switches etc. The main point is that a motor impulse should produce a directly noticeable effect.

To conceptual development it is also important that a child should be able to propel himself/herself across to an object and/or bring that object into close proximity and examine its qualities by means of the senses.

The projects described above aim at producing different control devices which can lay the foundations for the development of manipulators and control devices for those manipulators. Aids which increase mobility are thus important to childrens' development.

It thus follows that the primary research should include thorough analysis of physically disabled childrens' speech and language development.

Our stock of knowledge of this field still leaves much to be desired, in particular as regards any deviations from the speech and language development of ordinary children. We need to know more about how the vocabulary and syntax of a physically disabled child take shape and how he/she develops phonologically; the nature of the handicap means that such children are inhibited in many spheres which are assumed to be of fundamental importance to this aspect of development (project 2:7). Research in this field should yield results of great value to many other projects with an educational or technical slant which fall into the category, "Aids for speech-impaired, physically disabled children". It is highly probable that a project of the type suggested would open up new possibilities in a large number of fields in connection with the design of aids for the speech and

Fig. 6 Nalle (Sweden). Toy that stimulates children to speak. The eyes of the bear light up when the child produces a sound.

Fig. 7 Language Master (USA). Device for speech & language training. The cards contain an area for text and/or pictures and are provided with two soundtracks for recording and playing back of the voices of the teacher and the pupil.

language development of children with special needs.

One project with a bearing on this field involves relating images to sounds, see Fig. 7 (project 2:22). The learning mechanism requires teaching material where a picture and the registration of sound can be accomodated on the same page of standard format to facilitate filing. The recording and play-back apparatus should be as compact and easy to operate as possible.

New educational methods will have to be developed both for existing and future teaching material. A project concerned with the development educational methods is suggested by way of a joint effort (project 2:9).

7.3.2 Aids to communication using pictures, symbols or words

Small children are able to communicate at an early stage by pointing to an object or a picture. The scope offered by such a method is, however, limited and is hardly equal to a small child's communication needs. Project 2:7 may provide the know-how necessary to determine what form any aids to communication for this group should take.

Once a higher level of development has been reached, the person concerned can progress to the use of symbols and then possibly later to the written word.

Acoustic signals should also be tested in this context as a complement to the visual elements. A signalling device may be adequate for simple communication purposes; e.g. attracting attention, answering yes or no, asking questions etc, see Fig. 8 (project 2:23). A child's motivation to communicate can be kept alive by the feeling of being able to get through to people. Si-

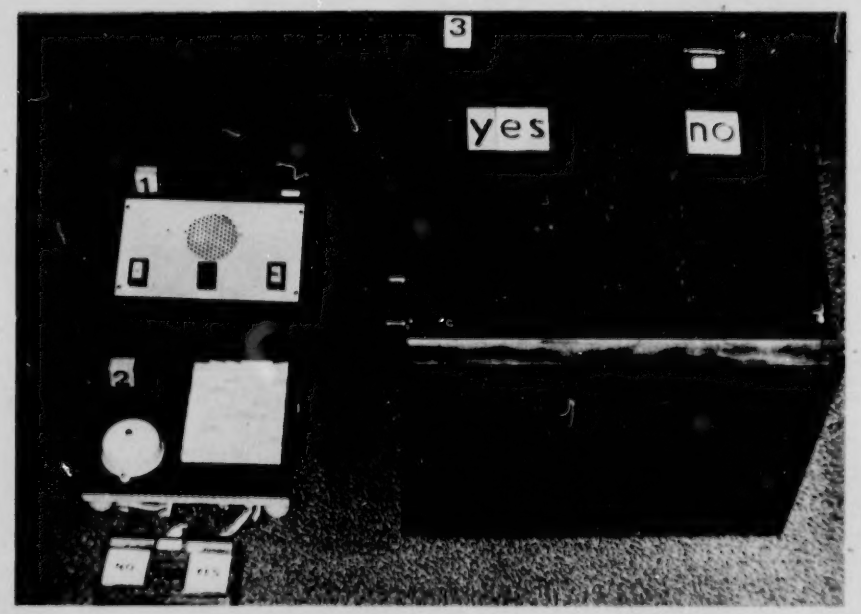


Fig. 8 Signalling devices (USA) can be used by severely handicapped persons to indicate "yes" or "no".

Fig. 9 A head-stick (Sweden) can be used by the physically handicapped person to select symbols or letters on a communication board or on a typewriter.

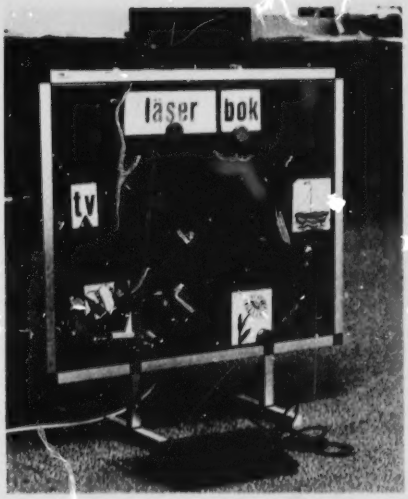


Fig. 10 Rotating pointer aid (Sweden). Pictures or letters can be selected by rotating the pointer. The device is controlled by a switch.

multaneous use of visual and acoustic signals can also provide the child with valuable stimuli. If the apparatus available could also reproduce speech, this would provide extra encouragement and would promote the learning of new words and concepts (cf section on synthetic speech). There is also a need for well-designed, durable individual symbol boards suitable for easy cleaning. It is suggested that a project (2:34) be initiated to develop such boards.

If a person is to be able to communicate with the help of symbols or pictures, he/she must be in a position to select (indicate) the symbol/picture to be expressed. Some type of indicator device must be provided for cases where the person in question is incapable of pointing out symbols himself, see Fig. 9. A project (2:24) which would involve inventing and developing improved indicator devices should therefore be started. This project should also include inventorying the existing range of devices (project 3:9).

Individualized devices for optimum positioning of symbol boards by their users also need to be developed, as to fixing devices (project 2:35).

There are many different types of aids which use scanning techniques to indicate the required symbol; e.g. devices where a pointer can be moved round a dial (Fig. 10) or where a light or illuminated square can be moved forward step-wise with the help of one or two switches (Fig. 11). Evaluation of the most interesting solutions should be undertaken (project 3:9).

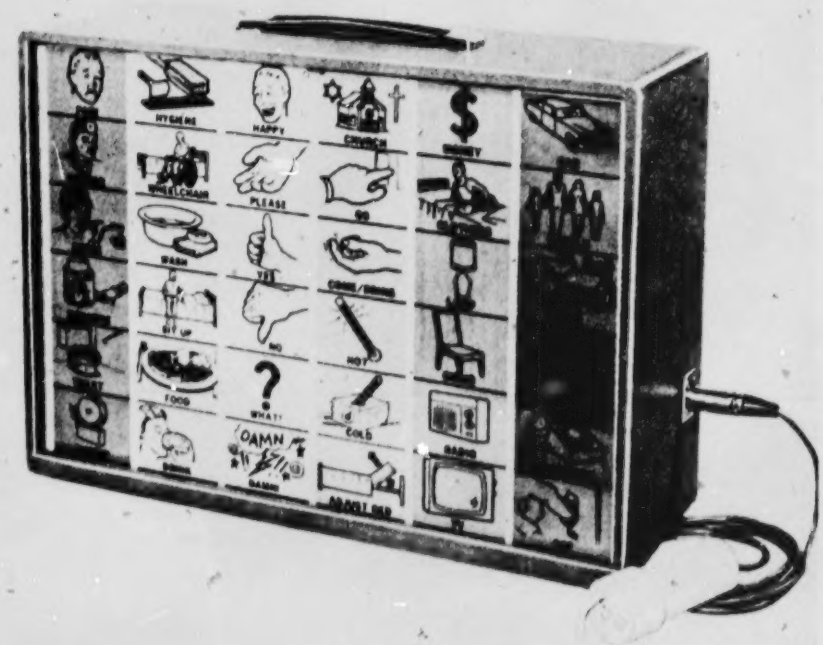


Fig. 11 Electronic communication board (USA). A switch lets the user light up any desired picture or symbol in any right-left, up-down sequences.

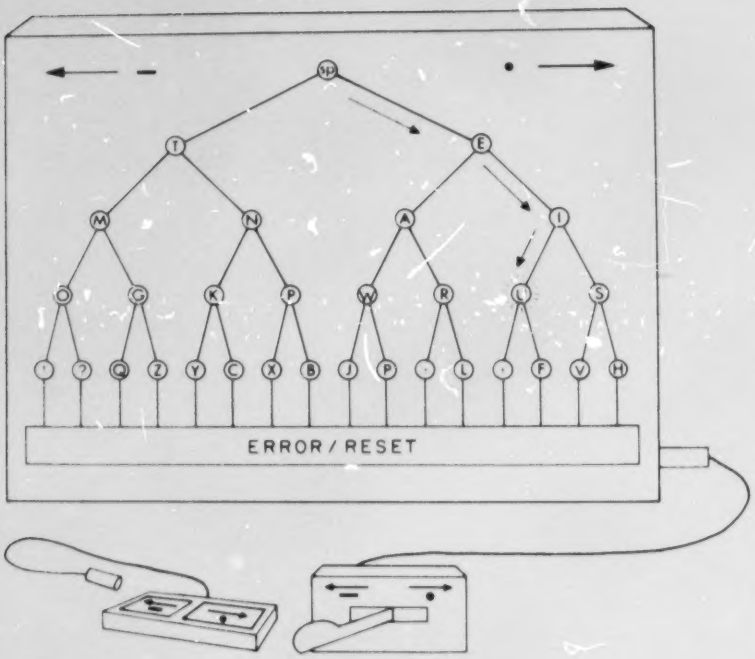


Fig. 12 The well-known Morse-code can be used to make a rapid selection of a desired letter. There are separate switches for dot and dash thus eliminating the requirement of producing short and long signals.
Illustration from Vanderheiden, G.C. & Grilley, K. Eds. Non-vocal Communication Techniques for the Severely Physically Handicapped, University Park Press. Baltimore, Maryland, 1976.

In order to increase speed in communication, different ways of encoding are sometimes utilized, see Fig. 12. The above mentioned project should include an evaluation of different principles of encoding.

Often it is a case of stationary apparatus which, because of its bulk and awkward format, is seldom used. Many pieces of apparatus have an extremely limited vocabulary or other disadvantages which mean that they are very seldom used as means of communication. A simple and inexpensive variant, the battery-operated communication roll, has the advantage of being suitable for mounting on a wheelchair and also of being battery-operated (Fig. 13). This means that a speech-impaired person can communicate in most situations, even though the number of alternative answers is very limited. An improvement has been suggested for this device which would increase its use potential; i.e. modification of its design to facilitate the insertion of rolls containing different material (project 2:25). Another important project which has been suggested involves the development of a portable, battery-operated symbol board designed for mounting on a wheelchair (project 2:26). Here again it is preferable to be able to insert material designed for special situations.

The devices referred to require a thoroughly thought out range of symbols and words adapted to various individual levels of development. A research project in linguistics (project 2:3) with this goal in mind should be followed by educational research (project 2:12) designed to transform research findings into educational methods whereby handicapped persons might be taught how to use the aids.

Fig. 13 Birgittarullen and the electric version Elrullen (Sweden) can be operated by the severely physically handicapped. A paper roll inside the plastic cylinder can be turned and messages written on the roll will be seen in a narrow window.

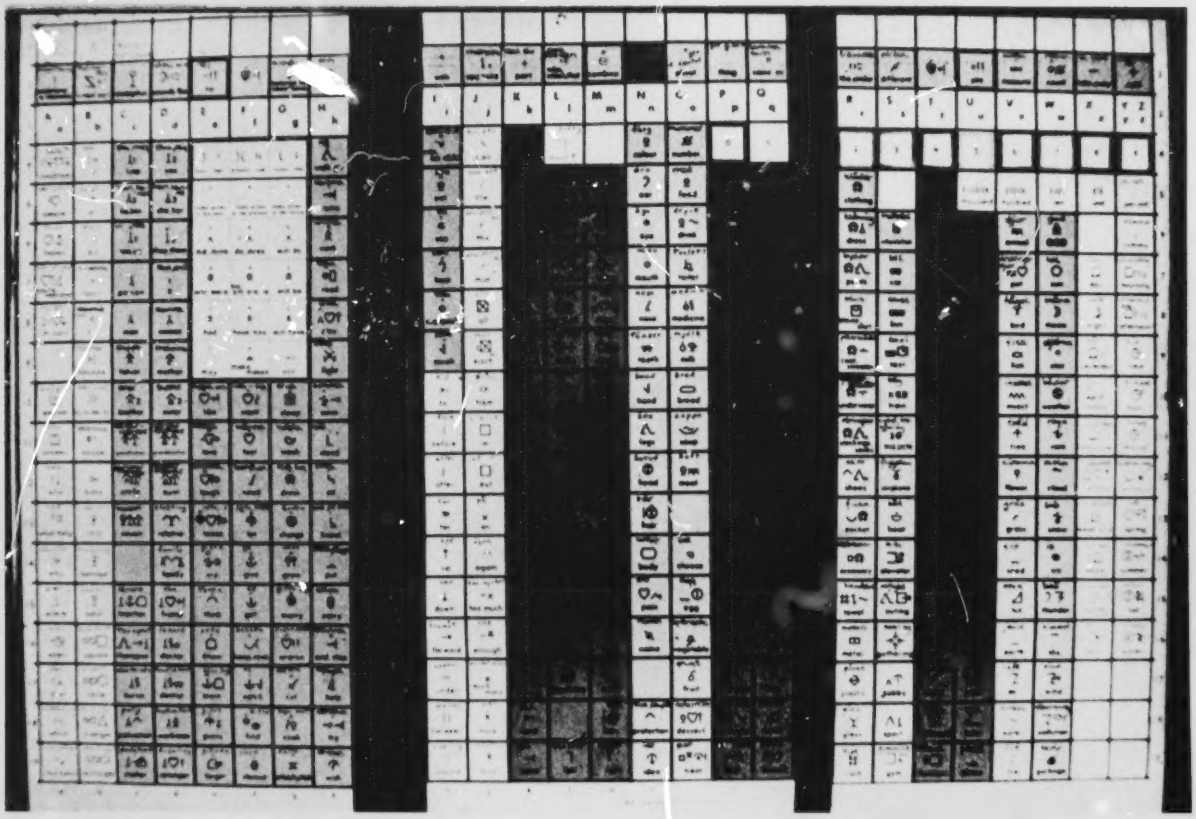


Fig. 14 One example of a communication board (USA) with a large vocabulary. A colour code makes the searching for a desired symbol easier.

Boards and displays for the presentation of material, or parts of it, must be designed for adaptation to individual needs (Beverley Vicker, 1974). Large vocabularies which are displayed in full make great demands of the user's perceptual capacity (Fig. 14). An innovative effort needs to be made to divide vocabulary into small groups and to present them in a manner which renders them easily comprehensible. This is a linguistic and technical problem and also one which falls within the sphere of perceptional psychology. The part concerned with language should be dealt with under the terms of project 2:4 and a special project should be started to handle the technical aspects (project 2:27) with a view to developing both manual and electronic displays which offer facilities for "leafing through" the material.

Picture books and similar aids are also needed containing material in the form of images/symbols or words which can be used in communicating with aphasiacs. Specially laid out material is needed for adults, often older persons who have suffered cerebral damage, see Fig. 15. The choice of design and contents of word/symbol boards and books should be based on research results derived, for instance, from work in the fields of neuropsychology and perceptional psychology. A special project (2:5) is recommended for the development of suitable materials.

Generally speaking, symbol boards etc have the major advantage of being relatively inexpensive to produce. This means that individualized units can be made for all speech-impaired persons capable of pointing to things with a certain degree of precision (Fig. 16). They can also be mounted on wheelchairs and require no energy supply for operation.

Fig. 15 Sometimes the most elementary needs can be expressed by pointing on a picture or a symbol chart.

Fig. 16 A portable letter chart is an indispensable aid for many speech handicapped persons.

Fig. 17 Versicom (USA). An electronic communication aid that can be mounted on a wheelchair. By using row-column scanning the letters can be selected on the display. The message is written on the light display or on a paper strip.

These aids do, however, have serious limitations, some of which are discussed by Eulenberg, 1977 as part of a comparison with electronic aids described at the beginning of the chapter. The main disadvantages are the limited number of linguistic units, the need for the receiving party's undivided attention, lack of printed reproduction and lack of scope for repeating a message composed previously. These disadvantages can be eliminated with electronic aids, which also offer persons with very limited motor potential the opportunity of communicating, see Fig. 17.

Examples of electronic systems of that type are also given by Eulenberg. The disadvantages involved which would prevent such systems being installed on a wide scale will in time become less significant. Costs will diminish as will size of devices and the amount of energy required for operation. The aids will become easier to handle and to program. New methods may lead to the emergence of new needs or may accentuate existing needs which are difficult to define. One example of this is the use of the "Bliss" symbols as a language of communication for certain speech-impaired children from nursery school age upwards and for persons who have difficulties with reading and writing (Fig. 18).

Fig. 18 Bliss-symbols
Illustration from leaflet on Bliss-symbols, Blissymbolics Communication Foundation, Toronto, Ontario.

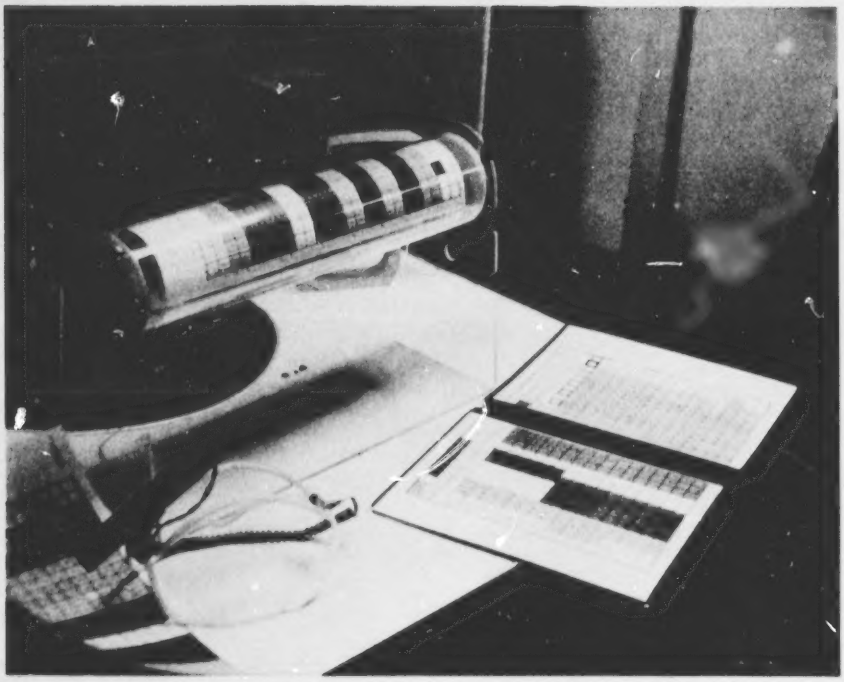


Fig. 19 Symbol chart (Canada) in the form of a roll for physically handicapped with limited range of movement. During transportation a foldable symbol chart can be useful.

This method has inspired the development of a whole series of new technical aids; e.g. specially designed symbol boards for people only able to reach a short distance with their index hand (Levy & Waksvik, 1977) (Fig. 19), and electronic displays with built-in memory whereby the position of each symbol selected is subsequently stored, so that symbols can be lit up one after another in the right order if needed again (Iles, 1976).

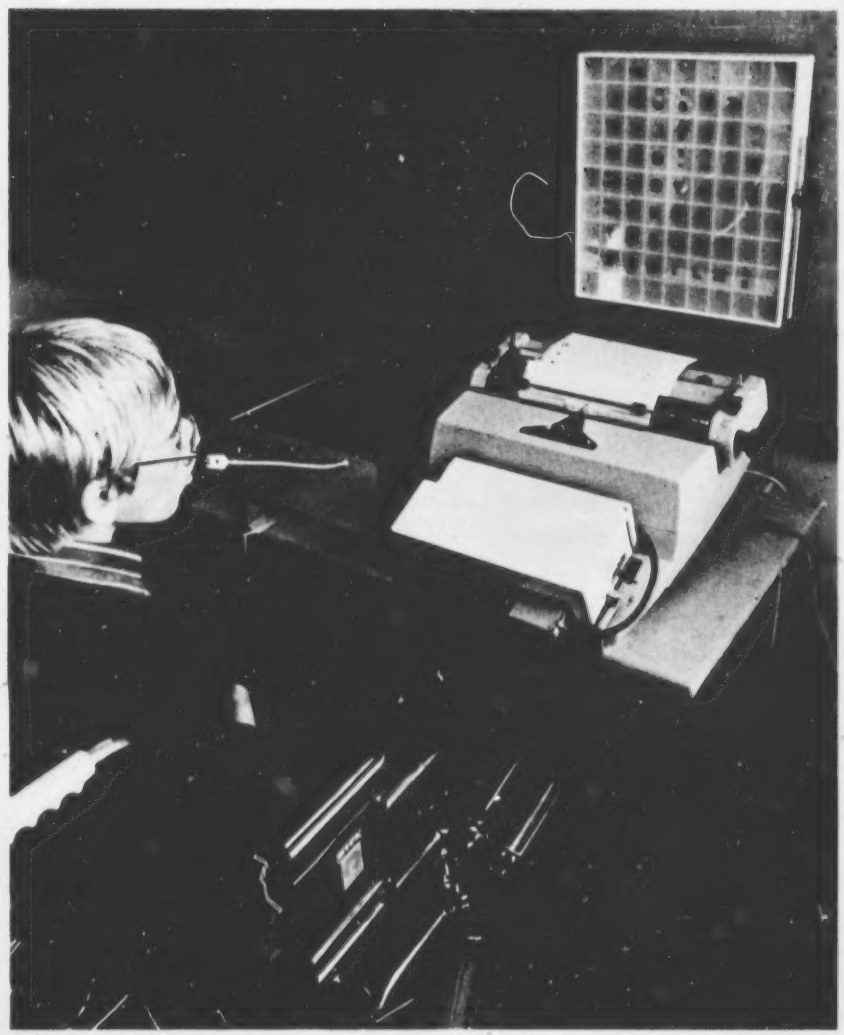
A system of this type makes it possible for a handicapped person to compose answers and messages quite independently without the receiving party's attention needing to be fixed on the board all the time. This is particularly valuable in cases where it takes long time to select the symbols. Manually operated boards do not offer this facility, although there is just as great a need to be able to reconstruct a sequence of symbols, possibly with the aid of markings on the symbol squares. This latter problem is a technical riddle which merits consideration as a separate project (project 2:28). The difficulty is that any marking system used cannot be allowed to conceal the symbols themselves.

7.3.3 Writing equipment

The area in which the speech-impaired are best provided with aids is that of writing equipment. Many variants have been developed for different groups of physically disabled persons since the advent of electric typewriters.

A wide range of devices is available for operating these typewriters, e.g. by means of sucking and blowing (Fig. 20), one or several switches, special keyboards (Fig. 21) for operation using the feet and so on. If a keyboard cannot be used, letters can be selected by scanning the entire alphabet or by using a code, in cases where several switches can be operated either simultaneously or in sequence.

Fig. 20 Electric typewriter with letter display (England). Symbols light up in sequence. Row- and column-scanning is controlled by mechanical or pneumatic switches. After selection the desired letter is typed on the typewriter.



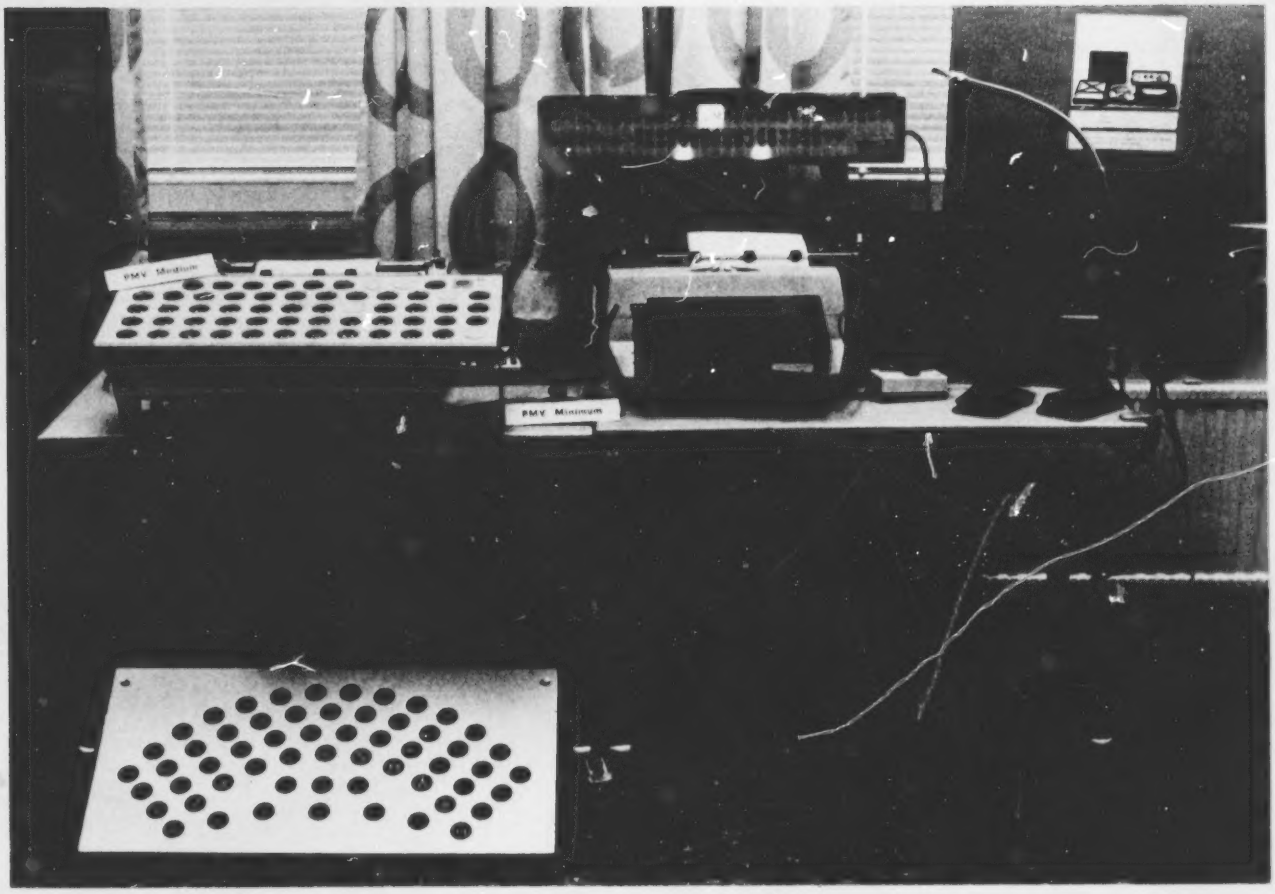


Fig. 21 Electric typewriters with specially designed keyboards for physically handicapped persons (Sweden).

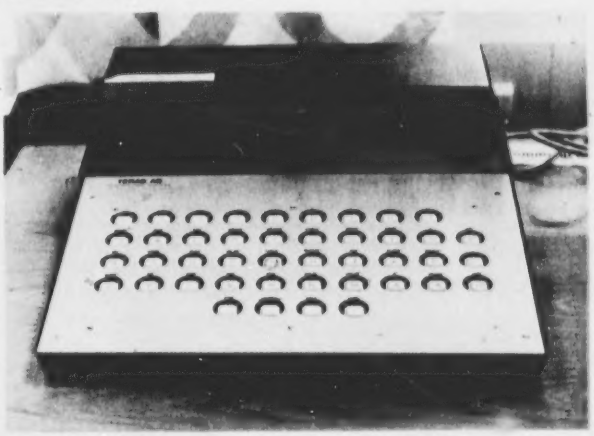
It may also be possible to use a sort of time code, if the person concerned can press a button at a certain rhythm in relation to acoustic signals. The aim of these methods is to increase the speed of writing. This latter increases with the number of parallel functions involved and/or increased speed of reaction. Another method involves the input of entire words and phrases, which can be selected just as quickly as a single letter. A system is at present being tested which offers fairly rapid access to syllables.

If writing equipment is used to communicate with someone standing beside the apparatus who can read off what has been written out, it may occasionally be considered undesirable to leave the message on the paper once it has been received. A system exists involving illuminated display or a television screen which erases old sentences as new ones appear. See Fig. 22.

Other systems are fitted with a printer. In such cases, the user can choose whether to leave the message on paper or whether merely to display it on a screen and then allow it to disappear. These systems are also suitable for correcting or editing text on a display and producing the final version on the printer.

As a fairly wide range of writing equipment is available, a systematic review and evaluation of the items should be undertaken (project 3:4, 3:5).

Fig. 22 Electronic writing aid with light displays (Sweden). One display is facing the user, one is facing the message receiver on the opposite side. The equipment also contains a storage for whole words and sentences.



Methods involving the introduction of typewriters for children have not yet reached a sufficient stage of development and should therefore be improved (project 2:10). It should be possible to make preparations at an early stage; a speech-impaired child would also probably be able to use a typewriter early in life as a means of communication using symbols other than the letters of the alphabet (project 2:11, 2:29).

A complicated printer for printouts of Bliss symbols is at present being developed in the USA (Silverman & Kelso, 1977).

In the course of the project on speech impairment, information has been acquired on a number of these portable writing devices which are manufactured in various countries. See Figs 23 and 24. Testing and evaluation of the use potential of these devices for the groups of speech-impaired persons mentioned would be useful. Furthermore, in doing so, an assessment should be attempted of any conceivable needs for adaptation or further development of portable printers, particularly in respect of the design of the keyboard (project 3:3).

There are portable word or symbol boards which also offer some scope for printouts. See Figs 5 and 17. Existing aids which fall into this category should be evaluated (project 3:10). This would certainly be an extremely interesting project in this context.

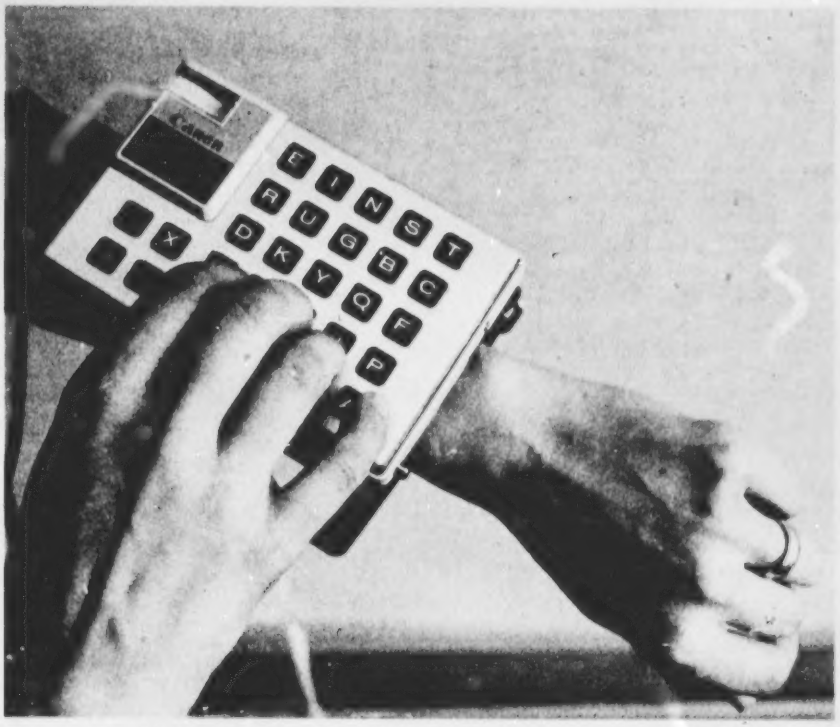


Fig. 24 Portable electronic writing aid. Messages are printed on a thermo-sensitive tape.

Fig. 23 Portable electronic writing aid with keyboard and light displays (The Netherlands). The message can be viewed from the user's as well as from the receiver's side.

7.3.4 Aids involving synthetic speech

Speech is the most natural and direct means which human beings have of communicating with each other. Speech-impaired persons who cannot produce an understandable form of speech usually have to resort to various alternative non-vocal means of communication discussed earlier in this report. Progress made in the development of synthetic speech generators is, however, opening new doors to the speech-impaired. There is much to be gained from spoken output, quite apart from the fact that it is a more natural means of communication; a spoken contribution can be heard by a number of persons in a room, even those not in the immediate vicinity or persons who have their attention turned in another direction. The transmission of messages by telephone becomes possible (cf. section on telecommunications) and also an increase in speed in certain instances.

Synthetic speech has been tested in educational contexts in Canada.

A symbol is selected on an electronic display for Bliss symbols (Kates et al, 1974) by means of scanning. Once the choice is complete, the word is read out by the synthetic speech device and the word is stored in a memory. It is then time to scan the next symbol and so on and so forth. When necessary the words stored in the memory can be repeated in the right order (Nelson, 1977).

Experiments have shown that synthetic speech is a valuable educational aid. Pupils' staying power has been more than doubled, while the speed of scanning has tripled. Most pupils started by giving answers in sentences of two or three words, whereas, before having been introduced to this system, they would reply with one key word. These "sentences" do not resemble natural speech, since the words are read out separately, without phrase rhythms and the intonation which is a characteristic of ordinary speech. Nor is it possible to decline verbs or to otherwise adopt common grammatical structures. The number of words available is also very limited. But for purposes of communication, it is of course better to be able to "utter" a few key words than none at all. However, a system must offer more than this if it is to be accepted by a large number of people.

Another system, which has been developed in Sweden (Jismalm, 1973) is capable of giving a more natural rendering of a text

which a speech-impaired person who is able to write has fed in via a keyboard. Here messages can be compiled at a linguistic level corresponding to the user's development state. Users can also influence the "reading" by marking the points at which emphasis is needed. This system is based on a computer-controlled synthetic speech unit which contains rules governing Swedish pronunciation, phonetics prosody and rules for translation from graphic to phonetic reproduction. Promising tests have been carried out on a speech-impaired, cerebral palsied schoolboy. To increase speed, the unit was programmed with a small number of frequently recurring words chosen by the user, which can then be selected by pressing a specific key.

One factor which may limit the use potential of synthetic speech for communication purposes is the time lag which occurs while a sentence is being written out. Methods should be developed to permit more rapid composition of messages, e.g. syntactic organization of a larger stock of words and phrases (Jismalm, 1973) (project 2:30).

If a user of Bliss symbols is to be able to communicate by means of synthetic speech, the set of rules will have to be supplemented by syntax (project 2:6).

The word memory system using a fixed vocabulary can be a valuable help for communicating with a limited circle of people e.g. friends and relations, for learning routines and possibly for certain groups (children, the mentally retarded). There is a need for synthetic speech devices with vocabularies of varying sizes, ranging, for instance from a very small number of words making it possible to reply "yes", "no", "don't know", "what is it" and other words designed to attract attention to fairly large ones containing perhaps several hundred words. A survey of the technical scope available has now been started in Sweden and should be followed by a detailed survey of needs (project 1:5). This material must then be used for field work (project 3:7) on both simulated systems and on prototypes, so as really to be able to draw up specifications of requirements. The technique is so new and its potential is so difficult to predict that no exact definition of requirements can be expected until experience has been gained of some system in operation.

Priority should therefore be given to the construction of a synthetic speech unit (project 2:31), as a system of this type would permit experiments in communication based on letters and in simulation of simpler systems involving word memories. It is important to be able to establish what psychological factors are involved in the use of synthetic speech for communication purposes. Questions concern reactions both of the transmitting party and of the receiving party, i.e. agreement, tolerance, naturalness, sound quality, personal features and speed (project 2:2). It would also be interesting to study how the user's language development, mental condition and inclination to communicate are affected.

Mini-taperecorders can satisfy part of aphasiacs' need to communicate. There are several makes already on the market and tests of the types available would be useful (project 3:6).

It should be possible to use tape recording techniques to a greater extent in educational contexts. For purposes of communication a speech-impaired person can use a tape-recorder for playing back a previously recorded message. An evaluation of different tape-recorders considering the needs of speech-impaired persons is suggested (project 3:12).

7.3.5 Telecommunications

Many speech-impaired persons would be able to communicate with relatives and friends if they had television links with each other. Videotelephones have been developed for this form of communication, but require a special telephony network, known as a wide-band network. A start on such a network cannot be expected for a long time in Sweden and the only means available today for the transmission of television links are those used for programme transmission. A certain amount of vacant capacity does exist, but should this be leased, the costs involved would be extremely high.

The existing telephony network can transmit speech and other tone signals, such as those used in telephones for the deaf (letter telephones, see Fig. 25). However, the scope is limited to contact with people who have similar telephone sets or through some form of clearing house.

Fig. 25 TV-phone (USA). Equipment for telephone communication. A necessary condition for communication is that both parties are equipped with compatible devices. Both the transmitted and the received messages appear visible on the television screen.

Speech-impaired persons with normal hearing need aids capable of reproducing speech, if they are to be able to participate in a telephone conversation. There is a number of conceivable systems with speech output ranging from word memory systems with vocabularies of varying size to synthetic speech units for the conversion of the written word into the spoken (cf. section on synthetic speech).

Expensive, complex systems with, for instance, computer-controlled synthetic speech units, can be used by a number of handicapped persons if centrally located at a telephone exchange and can be connected up by the speech-impaired person when required.

A control device could, for instance, be installed in the user's home adjusted to individual needs and capable of transmitting commands to the central system. Synthetic speech could then be fed into the telephone connection in a way whereby it would be audible to both parties, while answers would be transmitted in the usual way. Telephones with built-in loud-speakers can eliminate the problem of positioning the telephone receiver correctly. Any telephone of this type can render synthetic speech audible to a number of persons in a room, if synthetic speech equipment located at a distant point is to be used. Once a call has been put through to the unit, the command signals can be transmitted and the synthetic speech will be played back over the loud-speaker.

Other items of equipment which generate acoustic signals or speech (e.g. talking calculators) could perhaps be used for transmitting certain types of information, e.g. codes for key words on a list.

Telecommunications equipment offers a great deal of scope for increasing the amount of contact between handicapped persons, e.g. closed-circuit television at special schools, centres and so on. It is suggested that a technical study be carried out on alternative solutions to the need for telecommunications (project 2:32).

7.3.6 Aids to school work

The school system makes special, fairly clearly definable demands of the individual. This, coupled with the resources available in the school's sector, means that aids are used in teaching to a greater extent than in other situations; technical aids for the speech-impaired have however up to now been relatively sparsely used also in schools. Attending school requires independence and often a creative contribution on the part of the pupil. It is considered desireable that aids should be made available to handicapped pupils to help them satisfy these requirements.

When teaching and habilitating, for example, schoolchildren with serious motor disorders, special difficulties have been encountered in stimulating communication within a group. These children receive much of their training in the form of individual therapy and possibly also lack sufficient scope for establishing social contacts. This applies both to communication within the confines of a group of handicapped persons and between that group and the surroundings (nursing staff, teachers etc). It is becoming all the more common for seriously handicapped children to be integrated into ordinary schools, something which makes greater demands as regards communication in a group than is the case with more individualized teaching. See Fig. 26. A project should be started (project 1:6) to study how communication in a group might be made easier for the speech-impaired (in school, during leisure hours etc).

Many aids to communication are obvious accessories to teaching, but educational methods of using them are lacking. An educational project (project 2:13) should be started to remove existing deficiencies. There is also need for a technical study of new techniques which might improve teaching (project 2:33).

New, programmable aids could be used sucessfully in teaching. An evaluation of such systems is suggested for project 3:11.

Fig. 26 Keyboard with a TV-monitor (USA). The message on the TV-screen is fully legible to a group of people.

7.3.7 Aids in the work environment

Major difficulties arise when a physically disabled/speech-impaired person is transferred from school to the work situation. The choice of jobs is also very limited.

An inventory should be carried out of the jobs available, including a study of the need to adapt jobs to the needs of speech-impaired persons (project 1:4).

It may be assumed that there will be a demand for various aids to communication in working life. No precise definition can be given of these needs as yet, but we wish to underline the importance of turning attention to this specific field. In addition to satisfying the need for aids, we should also do everything to make it possible for speech-impaired persons to obtain jobs and to be able to function in the context of working life. It is regrettable that so many speech-impaired persons with serious motor disorders are retired with a pension at an early age and that, for instance, many laryngectomees stop working because of their handicap.

7.3.8 Aids for the mentally retarded

Many mentally retarded persons suffer from language and speech disorders and thus also have difficulty in communicating with those around them.

Many of the projects suggested may be expected to yield results which will be directly applicable even in the case of mentally retarded persons.

In some cases, however, it is probable that the capabilities and way of life of the mentally retarded will mean that an additional input of surveys, research and development work will be necessary. For example a specially designed education method might be requested. It was nevertheless considered neither possible nor appropriate to organize special projects designed solely to solve the communication problems of this particular group. Wherever possible, the mentally retarded should be included as one target group among others in the various projects. However, parallel projects may possibly be needed for this group in certain instances, while in others it may prove necessary to initiate projects designed specifically to deal with these problems. At present there is no basic material which might be used as a point of departure in attempting to indicate how the problems of the mentally retarded should be handled from the standpoint of aids to communication. Factors of decisive significance are, for instance, how the contents of the different projects is arranged at the implementation stage, how work on projects is organized and what resources are bound up with the different projects in terms of specialist knowledge.

7.3.9 Alternative means of expression

In conclusion, let us add some brief comments on the alternatives to spoken communication. Some people with speech or language disorders use various forms of sign language, gestures, mime and so on as a means of expressive communication.

Consideration of the problems entailed in the use of these alternative forms of expression lies outside the scope of this program. The fact remains, however, that it would be extremely valuable to have a coherent review of such alternatives open to different groups of users. To be able to fix criteria for the choice of suitable means of expression for persons with varying needs and prerequisites, we must first have a comparative evaluation of these methods of communication and be able to compare them with an evaluation of different technical aids.

In this context, it is essential to establish what possibilities the different modes of expression have to offer for users and for those on the receiving end, and what they require of the persons involved in the communication situation.

7.4 Resources needed to be able to implement the R&D programme planned

Provision of suitable aids for the handicapped requires resources in terms of both personnel and funds for research and development, manufacture, marketing, testing, dissemination of information, training, evaluation and follow-up.

In the following some brief comments will be given on the resources necessary for conducting research and development activities.

As the examples already given have demonstrated, the term "technical aids for the speech-impaired" covers the use of technologies of many different kinds. Some aids are technically speaking extremely simple (e.g. symbol charts on pieces of paper), while others are extremely advanced, e.g. minicomputer-controlled, programmable communication aids. New discoveries in the fields of electronics, control techniques, optics and so on, can be used in developing new and better aids. Speech synthesis is another area of technology which may be expected to play an increasingly important role in the context of providing aids for the speech-impaired.

It is important that the interest of young researchers should be stimulated in this field. The use of scholarships available for training young researchers for future appointment to qualified institutions under the guidance of competent research heads should offer considerable possibilities. The possibility of providing scholarships for specialization abroad should also be considered for persons who have already acquired a thorough grounding in the field.

Access must also be provided to know-how and basic data derived from other scientific fields such as psychology, linguistics, education, rehabilitation etc for technical research and development work to be meaningful. Many of the projects proposed are interdisciplinary in nature and in some cases know-how from related fields is necessary before work can be started on the development of an aid. This spotlights the fact that resources ranging far beyond the bounds of the technical field pure and simple are needed.

Various research institutions, firms whose operations are linked with the medical and technical fields and even companies already involved in the fields of aids for the handicapped or medical technology offer a resource potential in terms of the development of aids.

International co-operation in this field accompanied by the possibility of access to larger markets should encourage even major companies to begin showing a greater interest in the subject. The development of complex systems and advanced technology requires qualifications and resources which are normally only available in companies with large development divisions.

A characteristic feature of this field is that a large number of aids already exist, which have often been designed especially for a single user. It is particularly important that a system of evaluation be established so as to be able to make use of past experience in future research and development activities. There is doubtless also much to be gained from international co-operation in this context.

List of projects proposed

Introduction

The projects previously proposed in the report have below been arranged into three groups: a) Surveys of needs, b) Research and development projects, c) Testing projects.

On one hand there are projects which primarily require knowledge from technology, e.g. project 2:32 comprising a technical survey of methods for transmission of images as a means of telecommunication for the speech-impaired. Another project mainly technical to its nature is project 2:21 "Development of readily adaptable controls for proportional adjustment".

However, most of the projects proposed are interdisciplinary projects. In many cases there is a demand of knowledge from e.g. linguistics, psychology, education, technology, ergonomics and rehabilitation medicine.

One example of such an interdisciplinary project is project 2:5 "Development of sets of pictures and symbols adapted to the needs of adult aphasiacs and optimization of manner of presentation". The problem to be solved comprises aspects to be dealt with from various fields of knowledge, such as technology, rehabilitation medicine, linguistics, psychology of perception and neuropsychology.

An evaluation project which to a very high extent is interdisciplinary is project 3:9 "Evaluation of a number of interesting indication devices for use in conjunction with aids using a) direct selection, b) scanning or c) encoding". The evaluation should cover both control devices and principles of, e.g. scanning or encoding and therefore knowledge from ergonomics, psychology of perception and cognition as well as technical knowledge is needed.

List of projects proposed

		Page in R&D-programme
1.	**Surveys of Needs**	
	The following projects should be taken as **examples** of areas which constitute urgent cases for study	
1:1	Survey of size and composition of different categories of speech-impaired persons. Investigation of use of technical aids among persons with speech and language disorders.	16
1:2	Problems encountered in working life by people with weak voices. Review of size and composition of group.	17
1:3	Survey of group of persons suffering from speech disorders as result of neurological damage	16
1:4	Survey of labour market for the speech-impaired with motor disorders. Adaptation of job situation to their needs	32
1:5	Survey of need for word memory system with vocabularies of varying size	30
1:6	Survey of needs for technical aids to communication in the group	31
2.	**Research and development projects**	
2:1	Users and receivers' attitude to and acceptance of different aids to communication	16
2:2	Study of transmitters' and receivers' reactions to synthetic speech (acceptance, tolerance)	30
2:3	Optimization of ranges of words and symbols for different communication aids	23
2:4	Optimization of organization of vocabulary	24
2:5	Sets of pictures and symbols adapted to the needs of adult aphasiacs and optimization of manner of presentation	24
2:6	Survey of grammatical rules on translation of Bliss symbols to spoken language	30
2:7	Language and cognitive development of children with motor disorders (background to development of educational approaches and aids)	20
2:8	Use of bio-feedback principles in dealing with voice, speech- and language disorders: stutterers vocal disorders children with voice/speech/language disorders due to neurological damage deaf persons Review of literature and analysis of need for bio-feedback in various groups	18
2:9	Development of educational methods for language training, e.g. syntax, vocabulary and phonology taking into account the development level of the child and the external and internal environmental factors (incl. examination and necessary compilation of published material) Development of educational methods for application in conjunction with equipment associating sounds and pictures (see project 2:22)	21
2:10	Development of educational methods for introduction of typewriters and other writing systems	29
2:11	Development of educational methods for application in conjunction with use of symbol typewriters (vocabulary, syntax) (see project 2:29)	29
2:12	Development of educational methods for assimilation of the range of symbols in a given aid to communication	23
2:13	Development of educational methods for the application of communication aids in schools	31
2:14	Adaption of voice amplifiers to different work situations	16
2:15	Development of a few different types of microphones for mounting in the immediate vicinity of the mouth close to the oral opening	17
2:16	Development of artificial larynx with intonation control	17

2:17	Development of toys designed to stimulate sound and speech production	20
2:18	Development of aids for language stimulation of children with serious motor disorders	20
2:19	Inventory of control devices: types made, developed and tested	20
2:20	Development of standard range of control devices for schools, aids centres etc.	20
2:21	Development of readily adaptable controls for proportional adjustment	20
2:22	Development of equipment for the production of educational material which associates pictures and sounds	21
2:23	Development of signalling devices to provide for simple communication needs	21
2:24	Inventory and development of aids to help a person with motor disorders by selecting and pointing to pictures, symbols and so on on a symbol chart	22
2:25	Improvement of battery operated communication roll	23
2:26	Development of portable, electronic symbol chart	23
2:27	Development of manual and electronic displays with scope for "turning pages"	24
2:28	Development of systems for marking the sequence of symbols selected on a symbol chart	27
2:29	Development of writing systems using symbols other than letters (see project 2:11)	29
2:30	Development of methods permitting more rapid composition of messages	30
2:31	Development of portable synthetic speech appliance	30
2:32	Telecommunications Technical survey of methods for - transmission of images - adaption of letter telephones to the needs of the speech-impaired with motor disorders - transmission of symbols other than letters	31
2:33	Survey of how new techniques can improve teaching for pupils suffering from language and speech disorders	31
2:34	Development of methods and materials for manufacture of individualized symbol charts which are clear and durable	22
2:35	Development of devices and fixing devices for symbol charts and adaption of these to individual needs	22

3. Testing (including specification of requirements and evaluations)

3:1	Testing of a number of communication aids for laryngectomees	17
3:2	Evaluation of aids for persons suffering from velar insufficiency	17
3:3	Testing of portable writing apparatus (e.g. Elkomi, MiniComm, Canon, Talking Brooch)	29
3:4	Testing of the Lightwriter and of writing aid designed for anarthritics	28
3:5	Testing of stationary writing devices (Possum, PMV, Carba, Maling et al)	28
3:6	Testing of mini-taperecorders	30
3:7	Evaluation of prototype of synthetic speech appliances and various word memory systems	30
3:8	Evaluation of aids for stutterers	18
3:9	Evaluation of a number of interesting indicator devices for use in conjunction with aids using a) direct selection b) scanning c) encoding Evaluation should cover both control devices and principles of, e.g. scanning or encoding	22
3:10	Evaluation of portable communication charts with printout facilities (AutoCom, Versicom)	29
3:11	Evaluation of the Vidialog system	31
3:12	Evaluation of different tape-recorders considering the needs of speech-impaired persons.	30

International literature survey

An international literature survey on the topic of technical aids for the speech-impaired was initiated in 1975 within the project "Technical aids for the speech-impaired – internationally coordinated development work".

Data collection

The literature search was carried out within three settings:

1. Materials/papers available from various institutions around the world engaged in research and development activities within the interest area of technical aids for the speech-impaired were collected through international surveys 1975–1977.
2. Literature search through various databases available online in Sweden such as ERIC, INSPEC (ESA-RECON), MEDLARS I-II, Ex. Ch. Abstr., Project FAIR.
3. Manual search for information in existing journals within the fields of speech- and language therapy, rehabilitation medicine, bio-medical engineering etc available through the library service of the Swedish Institute for the Handicapped.

Reference Data

The literature survey comprises about 1 000 reference items on technical aids for the speech-impaired.

The reference material consists of scientific articles, abstracts, technical reports as well as brochures and leaflets from producers or marketing companies. The bulk of the material is hardware data on actual equipment.

Most of the material was gathered through manual search (70 %). The computer base literature search yielded about 20 % of the present material, while the remainder (10 %) stems from mail surveys to institutions.

Classification of literature references:

A. Technical aids for improvement of the individual's own speech

1. Technical aids for stutterers
2. Technical aids for persons suffering from cleft palate and velar insufficiency
3. Technical aids for laryngectomees and individuals suffering from insufficient vocal intensity
4. Technical aids within pre-speech- and language therapy
   a) machinery and equipment
   b) software (therapy programs etc)

B. Technical aids as an alternative mode of communication

1. Symbol systems, code systems, gesture languages
2. Communication boards, pointer displays/picture boards
3. Stationary writing devices
4. Portable writing devices
5. Signalling devices, alarm systems
6. Technical aids for non-vocal communication by telephone
7. Speech output devices

Under A. the subgroups include aids for stutterers, cleft palates, laryngectomees and individuals with voice problems. We have also included technical aids used in speech and language therapy in this category.

Under B. you will find aids mostly for individuals with very limited or no functional use of their own speech, where an alternative or supplementary mode of communication is necessary. These persons can utilize different forms of code or sign systems, pointer boards or signalling devices. They may also write with the help of portable or stationary electronic equipment. There are also aids for non-vocal communication by telephone as well as devices with built-in artificial speech output.

Database library service

Surveying the present activity within this field on an international basis hopefully a better coordination of information about existing technical aids and development projects for this population would be obtained.

It is intended that the literature reference material of this study be made available in its entirety through a computerized database library service through the Swedish Institute for the Handicapped.

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Technical aids for the speech-impaired - internationally coordinated development work

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Summary of the project report

Background

Individuals, who for various reasons suffer impaired speech capacity at present have very limited access to technical aids that may compensate their handicap.

It is known that aids, mostly custom-made for individuals are being developed in several parts of the world. Most of these aids have, however, not found their way to serial production. One of the reasons for this is that the speech-impaired make up a heterogeneous, yet relatively small group in any given country, thus making marketing and production of aids a difficult venture. Furthermore, the knowledge of the speech-impaired populations and their actual needs of technical aids is highly unsufficient to-day.

The establishment of international co-operation within the field of technical aids would no doubt contribute greatly towards answering the needs of the speech-handicapped for such aids. Possible areas for joint efforts are need analysis studies and evaluation studies as well as research and development work.

Therefore the Swedish Institute for the Handicapped in collaboration with the International Commission on Technical Aids, Housing and Transportation (ICTA) in 1975 initiated a project on technical aids for the speech-impaired. The project has been in progress for three years and funds for its implementation have been granted by the Swedish Board for Technical Development.

A Preparatory Swedish Committee of experts from various fields of knowledge such as phoniatrics, neurological rehabilitation, habilitation, special education and technology has been guiding the project from its inception.

One aim of the project has been to investigate the possibilities for international co-operation within the field of technical aids for the speech-impaired.

To provide material for future discussions around the topic of international co-operation a general review of the problem has been worked out as well as a tentative research and development programe.

Account of needs

Communication provides a means of establishing contact between human beings, to express feelings and emotions, to exchange information and thereby to exert some degree of control over the environment.

The spoken word constitutes the primary mode of communication between human beings. Those who are unable to speak or cannot make themselves understood adequately are also handicapped in their ability to communicate personal opinions and establish satisfactory social relations.

The term speech impairment is employed in a broad sense to cover all types of language, speech and voice disorders, i.e. communicative impairments, where a technical aid might conceivably solve the problem or at least reduce the effect of the handicap.

Two of the **language disorders** concerned are retarded speech and language development and aphasia, a disorder affecting the ability to understand or generate language due to brain injury. The **speech disorders** contain defects of pronounciation, anarthria/dysarthria due to neurological damage and the speech impairment of the individual with cleft palate or velar insufficiency. Stuttering is also classified among the speech disorders. **Voice disorders** include those of organic etiology (laryngectomy and paralysis of the vocal cords are two examples), as well as those functional in origin, e.g. voice disorders due to polyps on the vocal cords, phonastenia, psychogenic voice defects etc.

Different categories of speech impairments are described in the report. It is pointed out that the estimates presented of the number of speech-impaired persons could not be considered to represent the number of persons who might derive help from technical aids in solving their communication problems. In many cases speech therapy offers a solution to the problem of the speech-impaired person. In some cases a technical aid correctly applied can constitute an adequate replacement or compensation for loss of or impairment of communication mechanisms. The necessity of initiating studies with the aim to describe the populations and their actual needs of technical aids is stressed.

The concept of technical aids include various devices, the characteristics of which are quite different. A distinction should be made between aids intended to compensate or replace a lost function and aids designed to develop and generate a function which the speech-impaired person did not previously possess.

Since it was necessary for practical reasons to restrict the scope the work within this project has been focused on **personal communication aids.** However, the need for adequate aids for use in **training and treatment** cannot be sufficiently emphasized. Aids to **diagnosis** constitute another important field which was not possible to cover in the project.

The personal communication aids are:

I Aids to facilitate communication via a person's own speech function
  a) Aids to compensate for reduction/ disappearance of a function (e.g. artificial larynx for laryngectomees)
  b) Aids which assist a person's own speech organs in certain situations (e.g. speech amplifier)

II Aids which replace a person's own speech function (e.g. symbol charts, writing appliances, aids involving synthetic speech)

I. There is a need for a number of different types of aids designed to compensate for impairment or absence of the speech function thus permitting the individuals to use their own speech.

Appliances are also needed to facilitate the use of a person's own speech in a noisy environment and in unfamiliar surroundings where the listener is not used to the decoding of messages. This means that there is also a need for better telephone aids and means for using such aids via the public telephone network.

II. Some speech-impaired persons have very restricted means of utilizing their own speech for communication purposes. These individuals are often so severely communicatively impaired that their treatment requires a team effort of therapeutic and technical aid application.

For this group there is a need for a number of aids which are not based on the use of natural speech. Portable systems are needed which may be carried around by the individual user. The system must also be suitable for fitting on to a wheelchair. In some cases, stationary systems can be used, e.g. in classrooms, at work, for the bedridden. Systems developed must permit communication in a multitude of different real-life situations, e.g. signalling the presence of danger, communication for purposes of nutrition, dressing and similar ADL activities. It must also be possible for the person to maintain a large number of social contacts in the immediate environment and perhaps also in a broader context in society at large, at work, while travelling, for leisure time activities etc. In addition to aids permitting communication with the immediate environment, we predict a growing need for appliances permitting remote communication.

Different categories of communicatively impaired individuals might benefit from

the utilization of technical aids for communication which are not based on the use of natural speech. One group is comprised of those persons who have a communicative disorder of such severity that development or recovery of functional speech is precluded. Another category includes those persons who have a severe communication disorder but hold a prognosis for developing or recovering spoken speech. Yet another category includes those who in spite of their handicap manage to achieve a functional level of communication when in a familiar surrounding but who may be quite hampered by their speech disability in other situations and find great difficulties being understood by persons not used to their way of expression. In the latter cases a technical aid can provide a means of communication in certain situations while the individuals are simultaneously involved in the more longitudinal speech and language rehabilitation/habilitation procedures.

In the case of **children,** equipment is needed which is adapted to each step in the development of language and communication. The importance of providing a tool for very early communication is pointed out in the report. If a child does not seek to communicate or respond in communicative situations, a disruption occurs in the development of contact and communication processes which may be difficult or even impossible to repair at a later stage.

The **selection** of type of communication aid for an individual should be based on the careful assessment of the individual's capabilities in various respects. Linguistic competency, cognitive/intellectual abilities, emotional-motivation status, type of motor problem, degree of residual functional motor control are some important factors to examine. The presence of the motor ability to operate a particular aid may not necessarily indicate that the patient can use the aid as a functional tool for communication. The system must also be commensurate with the patient's intellectual and cognitive capabilities as well as his language competence.

Another matter of importance concerns the problem of **introduction of the aid.** Especially when it comes to more advanced and complicated systems it is essential to devote efforts to establish educational programs for the proper introduction and application of the systems. Furthermore there is a need for information on existing technical aids to those who describe them.

A lack of knowledge of available aids and the methodology for introducing these aids may be major restrictive factors to the utilization of well needed devices.

When discussing the role of technical aids in work with speech-impaired persons a hesitancy to introduce a nonvocal communication system is occasionally noticed. There is a fear that the patient will cease to be motivated to acquire vocal speech skills. It has however been reported from several researchers and clinicians that the use of nonvocal systems tends to facilitate spontaneous oral language, rather than delay it.

In many instances, aids need to be prescribed parallel to other forms of speech rehabilitation. The use of technical aids is one of many approaches to the rehabilitation or habilitation of speech-impaired persons whose ability to communicate is hampered by various disorders. It would be particularly unfortunate if we were to abstain from employing and developing current therapy methods as the supply and quality of technical aids increases. Technical aids can never replace therapy. More work must be done in the field of diagnostic research and therapeutic development work alongside research and development in the field of technical aids in order to improve the overall treatment.

Draft research and development programme

The research and development measures suggested are based on information extracted from literature on this subject and on experience plus qualitative assessment of description of needs observed in the course of field work. They are also based on assumptions as to how some possible aids could improve things for a speech-impaired person. The draft should therefore be regarded as a basis for discussion, which can be filled out as new research findings emerge, the pattern of needs crystallizes and resources are increased.

It is important that more detailed surveys of the needs of the different diagnosis groups be carried out to ensure a more reliable basis for assessments. The problems which should be examined are the consequences of a speech or language disorder for the life and development of the person afflicted and the dilemmas and difficulties experienced by such people in various everyday situations. This approach provides more reliable material for assessment of, for instance, the need for research and development. The draft programme presented in this report advocates a number of these need surveys and these may serve as an illustration of the type of studies which may be considered in the future.

A characteristic feature of this field is that a large number of aids already exist, which have often been designed especially for a single user. It is particularly important that a system of **evaluation** be established so as to be able to make use of past experience in future research and development activities. There is doubtless also much to be gained from international co-operation in this context.

This Research & Development programme is not limited to projects of a purely technical nature. In some cases, knowledge of other scientific fields is also necessary, e.g. psychology, education, sociology and medicine. In many instances, it is a case of **interdisciplinary efforts.** The projects proposed can be classified as need analysis studies, research & development projects and evaluation studies.

One general category of technical aids are those making it possible for persons to communicate using their own faculties of speech, intended for persons with weak voices, laryngectomees, persons suffering from velar insufficiency, persons with a stutter and so on. A number of aids are available, e.g. amplifiers, artificial larynges, prosthetic appliances. Testing of these devices and further functional and technical improvement are considered.

Another general category of technical aids makes it possible for a person to express himself/herself by **alternative (non-vocal) means of communication,** if the person is unable to speak or if for some reason the use of speech is not advisable.

The importance of providing the **non-speaking child** with a means to communicate should be stressed. A prerequisite for communication is that the child develops language and a will to communicate. For children with serious physical disabilities a range of different toys and appliances should be designed providing the child with experiences important to language development.

A child can be stimulated to make sounds and to **speak** with the help of toys which react to sounds or to a certain category of sound. Various equipment of this kind is suggested.

Small children are able to communicate at an early stage by pointing to an object or a picture. The scope offered by such a method is, however, limited and hardly meets a small child's communication needs. Once a higher level of development has been reached, the person concerned can progress to the use of symbols and then possibly later to the written word.

If a person is to be able to communicate with the help of **symbols** or **pictures**, he/she must be in a position to select (indicate) the symbol/picture to be expressed. Some type of **indicator device** must be provided for cases where the person in question is incapable of pointing out symbols himself. A project which would involve inventing and developing improved indicator devices is therefore suggested.

There are many different types of aids which use **scanning techniques** to indicate the required symbol; e.g. devices where a pointer can be moved around a dial or where a light or an illuminated square can be moved forward step-wise with the help of one or two switches. Evaluation of the most interesting solutions should be undertaken.

Boards and displays for the presentation of material, or parts of it, must be designed for adaptation to individual needs. Large vocabularies which are displayed in full make great demands of the user's perceptual capacity. An innovative effort needs to be made to divide vocabulary into small groups and to present them in a manner which renders them easily comprehensible. This is a linguistic and technical problem and also one which falls within the sphere of psychology of perception.

A new approach within communication rehabilitation is the use of the **"Bliss symbols"** as a language of communication for certain speech-impaired children from nursery school age upwards and for persons who have difficulties with reading and writing. This method has inspired the development of a whole series of new technical aids; e.g. specially designed symbol boards for people only able to reach a short distance with their index hand and electronic displays with built-in memory whereby the position of each symbol selected is subsequently stored, so that symbols can be lit up one after another in the right order if needed again. A system of this type makes it possible for a handicapped person to compose answers and messages quite independently without the receiving party's attention needing to be fixed on the board all the time. This is particularly valuable in cases where it takes long time to select the symbols. Manually operated boards do not offer this facility. Development of aids which makes the use of Bliss symbols available also for the severely physically handicapped is suggested.

The area in which the speech-impaired are best provided with aids today is that of **writing equipment.** Many varieties have been developed for different groups of physically disabled persons since the advent of electric typewriters. A wide range of devices is available for operating these typewriters, e.g. by means of sucking and blowing, one or several switches, special keyboards for operation using the feet and so on. If a keyboard cannot be used, letters can be selected by scanning the entire alphabet or by using a code, in cases where several switches can be operated either simultaneously or in sequence.

Another method to increase writing speed involves the storage of entire words and phrases, which can be selected just as quickly as a single letter.

If writing equipment is used to communicate with someone standing beside the apparatus who can decode what has been typed, it may occasionally be considered undesirable to leave the message on the paper once it has been received. System exists involving illuminated display or a television screen which erases old sentences as new ones appear. Other systems are fitted with a printer. In such cases, the user can choose whether to leave the message on paper or whether merely to display it on a screen and then allow it to disappear. These systems are also suitable for correcting or editing text on a display and producing the final version on the printer.

A number of **portable writing devices** are available. Testing and evaluation of the use potential of these devices for the group of speech-impaired persons would be useful, as would be evaluations of the above mentioned stationary equipment.

Progress made in the development of **synthetic speech** generators is opening new doors to the speech-impaired. There is much to be gained from spoken output, quite apart from the fact that it is a more natural means of communication; a spoken contribution can be heard by a number of persons in a room, even those not in the immediate vicinity or persons who have their attention turned in another direction. The transmission of messages by telephone becomes possible (cf. section on telecommunications) and also an increase in speed in certain instances.

Synthetic speech has already been successfully tested in educational contexts and several systems for conversion of text into speech have been developed.

One example is a system based on a computer-controlled synthetic speech unit which contains rules governing pronunciation, phonetics prosody and rules for translation from graphic to phonetic reproduction. To increase speed, the unit was programmed with a small number of frequently recurring words chosen by the user, which can then be selected by pressing a specific key.

One factor which may limit the use potential of synthetic speech for communication purposes is the time lag which occurs while a sentence is being written out. Methods should be developed to permit more rapid composition of messages, e.g. syntactic organization of a larger stock of words and phrases.

If a user of Bliss symbols is to be able to communicate by means of synthetic speech, the set of rules will have to be supplemented by syntax.

Telecommunications equipment offers increasing possibilities for contact between handicapped persons, e.g. closed-circuit television at special schools, centres and so on. It is suggested that a technical study be carried out on alternative solutions to the need for telecommunications.

Expensive, complex systems with, for instance, computer-controlled synthetic speech units, can be used by a number of handicapped persons if centrally located at a telephone exchange and can be connected up by the speech-impaired person when required.

Provision of suitable aids for the handicapped requires **resources** in terms of both personnel and funds for research and development, manufacture, marketing, testing, dissemination of information, training, evaluation and follow-up.

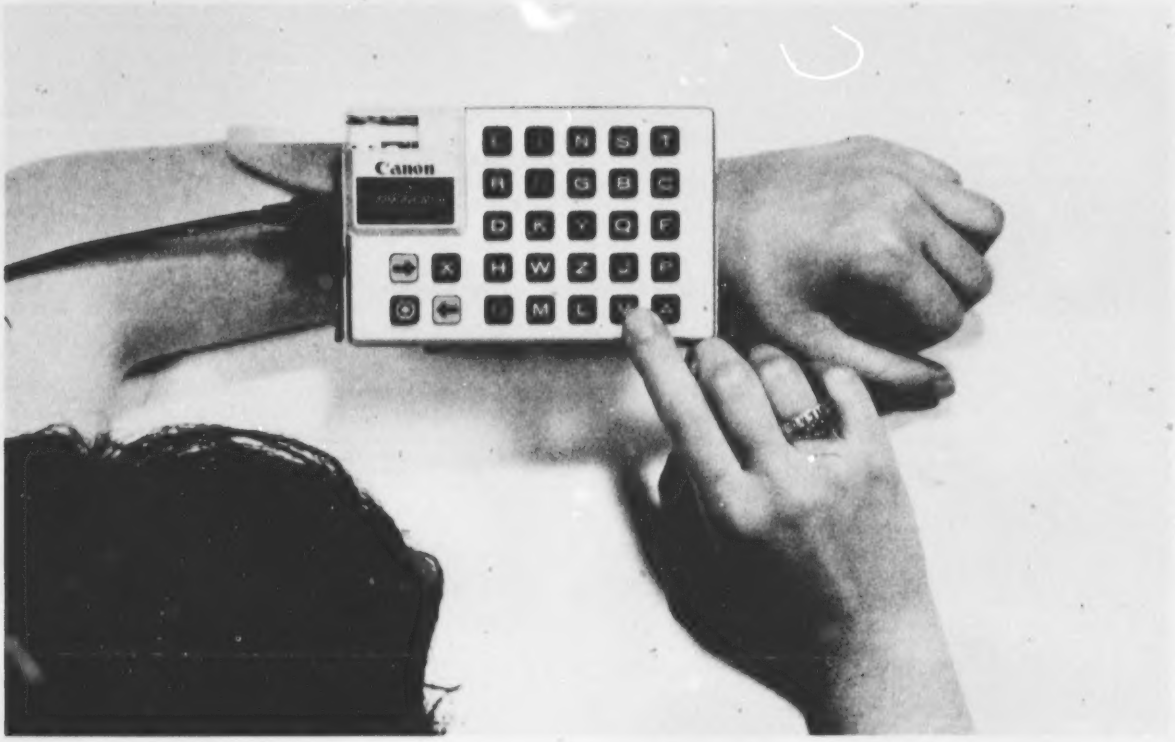
Access must also be provided to know-how and basic data derived from other scientific fields such as psychology, linguistics, education, rehabilitation etc. for technical research and development work to be meaningful.

It is important that the interest of young researchers should be stimulated in this field. The use of **scholarships** available for training young researchers for future appointment to qualified institutions under the guidance of competent research heads should offer considerable possibilities. The possibility of providing scholarships for specialization abroad should also be considered for persons who have already acquired a thorough grounding in the field.

International co-operation in this field accompanied by the possibility of access to larger markets should encourage even major companies to begin showing a greater interest in the subject. The development of complex systems and advanced technology requires qualifications and resources which are normally only available in companies with large development divisions.

CANON COMMUNICATOR

A2. 65-1
1978



This communication aid is designed as an electronic mini-typewriter and intended for persons with insufficient capabilities to communicate by means of speech, symbols or handwritten messages. It can be worn on the wrist, attached to the armrest of a wheelchair, and if provided with an extension belt fixed on either the leg or the waist. The keyboard consists of 26 keys: one for each letter of the alphabet, a shiftkey, a backkey and a spacekey. With the shiftkey pressed, a second series of characters consisting of the numbers 0 to 9, punctation marks and some specific letters can be printed. To prevent double strokes a thin keyboard cover can be used for persons with impaired finger stability and a thick one for persons operating the keyboard by means of a head- or mouth-stick. The communicator can also be equipped with a braille dummy keyboard for blind persons. The maximum printing speed is 10 characters per 1 second and the text appears in dotted print on a 50 m long thermal print tape which can hold up to 12,500 characters. A mechanical click-system gives the user an acoustic feed-back in addition to the visual and sensorial control. The communicator is powered by a nickel-cadmium battery, which can be worn e. g. in a pocket or on a belt. The battery is claimed to last 7 hours at one character per second, which means about 2 tape rolls. The charging of the battery takes about 20 hours and can be repeated about 500 times by using the included battery charger.

Dimensions	**Communicator**	**Battery**
Length:	128 mm	87,5 mm
Width:	85 mm	70 mm
Height:	30 mm	19 mm
Weight:	300 g	180 g

Approx. price in the Netherlands: Dutch guilders 1 100

Manufacturer:
Canon Amsterdam N.V.
Gebouw 70
Schiphol Oost
The Netherlands

Tested by the Swedish Institute for the Handicapped and recommended for free prescription in Sweden.

CANON COMMUNICATOR

Cet auxiliaire de communication, concu sous la forme d'une minimachine à écrire électronique, est destiné aux personnes qui ne sont pas en mesure de communiquer par la voie du langage, de symboles ou de messages écrits à la main. Il peut se porter au poignet, se monter sur l'accoudoir d'un fauteuil roulant ou, complété par une courroie, se fixer sur une jambe ou sur la taille. Le clavier comporte 26 touches: une pour chacune des lettres de l'alphabet, plus une touche de changement, une touche de rappel et une touche d'espacement. L'utilisation de la touche de changement permet d'obtenir une seconde série de caractères, constitués des chiffres de 0 à 9, des signes de ponctuation et de quelques caractères spéciaux. Pour éviter les doubles frappes, il est possible d'utiliser un couvre-clavier mince pour les personnes qui ont des difficultés à guider leurs doigts, ou épais pour celles qui actionnent les touches au moyen d'une baguette fixée au front ou tenue dans la bouche. L'appareil peut aussi être équipé d'un clavier braille pour non-voyants. La vitesse d'impression maximale est de 10 caractères à la seconde et le texte apparaît en pointillé sur une bande spéciale pour impression thermique longue de 50 m, pouvant contenir jusqu'à 12 500 caractères. Un système à déclic mécanique donne à l'utilisateur une possibilité de contrôle acoustique, venant s'ajouter à la vue et au toucher. L'appareil est alimenté par une batterie au nickel-cadmium que l'on peut par exemple placer dans une poche ou fixer à une courroie. Selon le constructeur, cette batterie a une autonomie de 7 heures au rythme de 1 caractère à la seconde, ce qui correspond donc à environ 2 bobines de bande. Il faut environ 20 heures pour recharger la batterie, avec le chargeur fourni avec l'appareil, et le nombre de recharges peut aller jusqu'à 500.

Dimensions	Communicator	Batterie
Longueur:	128 mm	87,5 mm
Largeur:	85 mm	70 mm
Hauteur:	30 mm	19 mm
Poids:	300 g	180 g

Prix approximatif aux Pays-Bas: Fl 1 100

Fabricant:
Canon Amsterdam N.V.
Gebouw 70
Schiphol Oost
Pays-Bas

Les renseignements ci-dessus sont extraits de la documentation fournie par le fabricant.

CANON KOMMUNIKATOR

Diese Kommunikationshilfe ist als elektronisch arbeitende Miniatur-Schreibmaschine hergestellt und für Personen gedacht, die sich nur mangelhaft durch Sprache, Symbole oder handschriftliche Mitteilungen verständigen können. Das Gerät kann am Handgelenk getragen, an der Armlehne eines Rollstuhls, und — wenn es mit einem Verlängerungsgurt ausgestattet ist — entweder am Bein oder an der Taille befestigt werden. Die Tastatur besteht aus 26 Tasten, d.h. einer für jeden Buchstaben im Alphabet, einer Umschalttaste, einer Rücktaste und einer Leertaste. Wenn die Umschalttaste gedrückt ist, erscheint eine zweite Reihe von Schriftzeichen, die aus den Zahlen von 0—9, Satzzeichen und einigen Spezialtypen besteht. Um Doppelanschläge zu vermeiden, kann eine dünne Tastaturabdeckung verwendet werden für Personen, deren Fingerstabilität beeinträchtigt ist, während eine dicke Abdeckung für Personen verwendet wird, die die Tasten mit einem Stirn- oder Mundstab bedienen. Diese Kommunikationshilfe kann auch mit einer Braille-Tastatur für Blinde ausgestattet werden. Die maximale Schreibgeschwindigkeit liegt bei 10 Schriftzeichen pro Sekunde, und der Text erscheint in Matrixschrift auf einem 50 m langen Thermo-Schreibband, das bis zu 12.500 Schriftzeichen aufnehmen kann. Eine mechanische Klickeinrichtung vermittelt dem Benutzer des Geräts eine akustische Rückmeldung, zusätzlich zu der visuellen Kontrolle und Tastwahrnehmung. Der Kommunikator wird von einer Nickel-Kadmiumbatterie gespeist, die z.B. in der Tasche getragen bzw. am Gürtel befestigt werden kann. Nach den Angaben des Herstellers reicht die Batterie 7 Stunden bei einem Schriftzeichen pro Sekunde, d.h. etwa 2 Schreibrollen. Das Aufladen der Batterie dauert etwa 20 Stunden und kann unter Verwendung des mitgelieferten Batterieladegeräts ungefähr fünfhundertmal wiederholt werden.

Abmessungen	Kommunikator	Batterie
Länge:	128 mm	87,5 mm
Breite:	85 mm	70 mm
Höhe:	30 mm	19 mm
Gewicht:	300 g	180 g

Zirkapreis in den Niederlanden: Holländische Gulden 1 100

Hersteller:
Canon Amsterdam N.V.
Gebouw 70
Schiphol Oost
Die Niederlanden

Getestet von dem schwedischen Behinderteninstitut und für freie Ordination in Schweden empfohlen.

COMUNICADOR CANON

Este auxiliar de comunicación tiene el diseño de una máquina de escribir electrónica en miniatura y está previsto para personas con una capacidad insuficiente para comunicarse mediante el habla, símbolos o mensajes escritos a mano. Puede llevarse en la muñeca, fijarse en el apoyabrazos de una silla de ruedas y, provisto de una correa de prolongación, puede fijarse en las piernas o la cintura. El teclado consta de 26 teclas: una para cada letra del alfabeto, una tecla de cambio y teclas de retroceso y espaciado. Con la tecla de cambio apretada puede imprimirse una segunda serie de signos formada por los números del 0 al 9, los signos de puntuación y algunas letras especiales. Para evitar que las personas con una estabilidad defectuosa de los dedos realicen pulsaciones dobles puede emplearse una tapa de teclado delgada. Existe una tapa gruesa para las personas que pulsan el teclado mediante una varilla en la cabeza o la boca. El comunicador también puede equiparse con un modelo de teclado braille para las personas ciegas. La velocidad de impresión máxima es de 10 signos por segundo y el texto se presenta en escritura de puntos en una cinta de impresión térmica de 50 metros de longitud que puede alojar hasta 12.500 signos. Un sistema de "clic" mecánico produce una señal acústica de nueva pulsación, aparte del control visual y sensitivo. El comunicador es accionado por una batería de níquel-cadmio que puede llevarse, por ejemplo, en el bolsillo o en un cinturón. La duración de la misma alcanza para 7 horas escribiendo un signo por segundo, lo cual equivale a alrededor de 2 rollos de cinta. La carga de la batería precisa de unas 20 horas, pudiendo recargarse alrededor de 500 veces empleando el cargador que se acompaña.

Dimensiones	Comunicador	Batería
Largo:	128 mm	87,5 mm
Anchura:	85 mm	70 mm
Altura:	30 mm	19 mm
Peso:	300 g	180 g

Precio aproximado en los Países Bajos: Fl 1 100

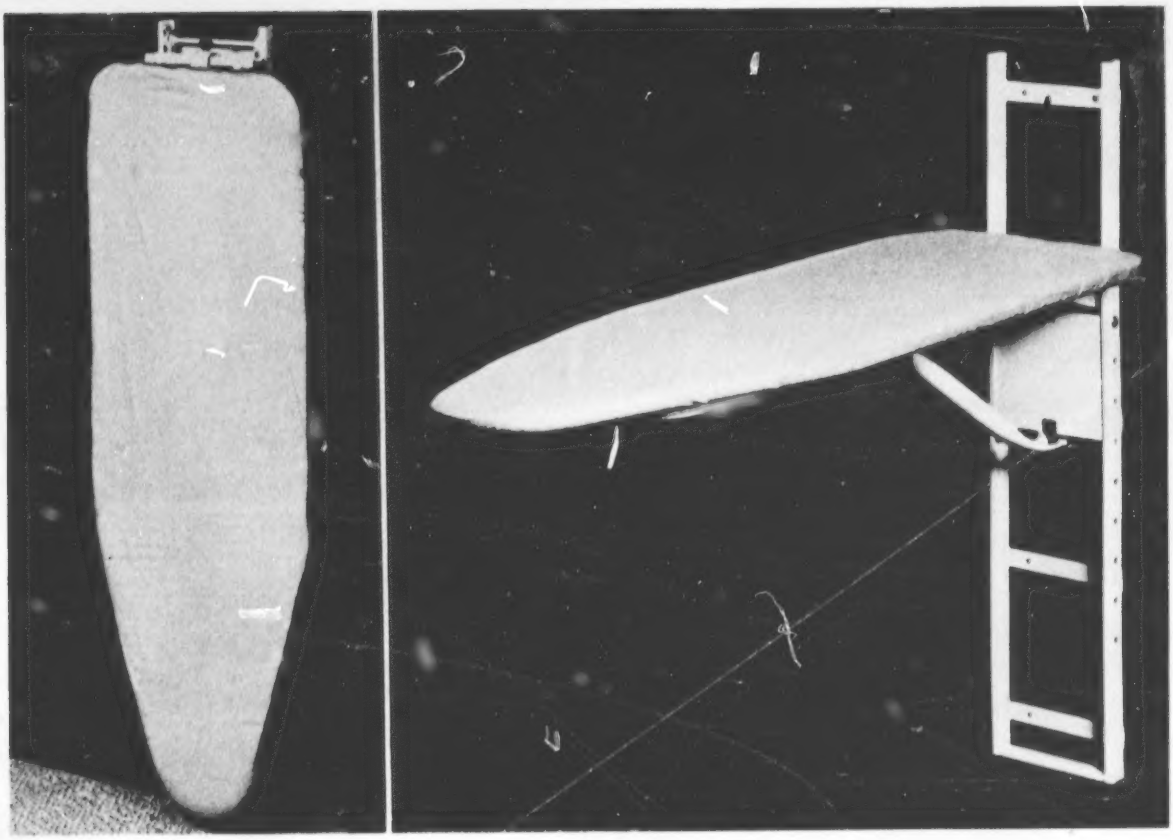
Fabricante:
Canon Amsterdam N.V.
Gebouw 70
Schiphol Oost
Países Bajos

Las informaciones extraidas de la literatura del fabricante.

POGO PRINT STHLM 1979

IRONING BOARD

A1. 33-1
1978



This wall-mounted ironing board, which also can be used as a kitchen work-table, is claimed to be suitable for i.a. wheelchair users. It consists of a braced steel frame, a 1067 × 356 mm playwood board covered with a foam pad, and a scorch-resistant ironing board cover made of aluminium coated cotton. The steel frame is secured to the wall and the ironing board itself is mounted on the wall frame so that it can be erected and folded away by using only one hand. The table height is adjustable between 550 and 930 mm in 25 mm increments, provided that the steel frame is fixed on the wall 250 mm above floor level. For heights above 930 mm the wall frame can be mounted on the wall in a higher position.

Approx. price in the U.K.: £ 18.90
excl. tax

Manufacturer:
John R. Edwards & Co.
P.O. Box 13
Marlow
Bucks SL7 3NR
England

Information is taken from manufacturer's literature.

PLANCHE A REPASSER

Cette planche à repasser fixée au mur, également utilisable comme plan de travail dans une cuisine, est dite convenir aux personnes obligées d'utiliser un fauteuil roulant. Elle se compose d'un cadre en acier du type échelle, d'une plaque en contreplaqué de 1067 × 356 mm recouverte de plastique mousse et d'une housse résistant aux éraflures en coton doublé d'aluminium. Le cadre en acier se fixe au mur et la planche à repasser se monte sur ce cadre de telle manière qu'il soit possible de la relever et la rabattre avec une seule main. Sa hauteur est réglable entre 550 et 930 mm, par paliers de 25 mm, ceci dans la mesure où le cadre est fixé au mur à 250 mm du sol.

Si l'on désire obtenir des hauteurs supérieures à 930 mm, il suffit de fixer le cadre plus haut sur le mur.

Prix approximatif en Angleterre: £ 18.90
H.T.

Fabricant:
John R. Edwards & Co.
P.O. Box 13
Marlow
Bucks SL7 3NR
Angleterre

Les renseignements ci-dessus sont extraits de la documentation fournie par le fabricante.

BÜGELBRETT

Dieses an der Wand befestigte Bügelbrett, das auch als Küchenarbeitstisch verwendet werden kann, ist nach Angaben des Herstellers unter anderem für Rollstuhlbenutzer geeignet. Es besteht aus einem verstrebten Stahlrahmen, einer Sperrholzplatte 1067 × 356 mm, die mit Schaumstoff gepolstert ist, und einer versengungsbeständigen Hülle aus aluminiumbeschichteter Baumwolle. Der Stahlrahmen wird an der Wand befestigt und das Bügelbrett selbst an den Wandrahmen montiert, so dass es mit nur einer Hand aufgerichtet und heruntergeschwenkt werden kann. Die Tischhöhe ist einstellbar zwischen 550 und 930 mm, in Stufen von 25 mm, vorausgesetzt, dass der Stahlrahmen in einer Höhe von 250 mm über dem Fussboden an der Wand befestigt wird. Um eine Tischhöhe über 930 mm zu erhalten, wird der Rahmen höher über dem Fussboden an die Wand montiert.

Zirkapreis in England: £ 18.90
exkl. Steuer

Hersteller:
John R. Edwards & Co.
P.O. Box 13
Marlow
Bucks SL7 3NR
England

Die Informationen stammen aus Herstellerliteratur.

TABLA DE PLANCHAR

Esta tabla de planchar de montaje mural, que también puede emplearse como banco de trabajo de cocina, según se informa es adecuada, por ejemplo, para personas que emplean silla de ruedas. Consiste en un armazón entramado de acero, un tablero de madera contrachapada de 1067 × 356 mm cubierto con un almohadillado de espuma, y una cubierta para planchar resistente al calor y a las quemaduras fabricada de algodón revestido de aluminio. El armazón de acero se fija a la pared y la tabla de planchar propiamente dicha se monta al armazón de modo que pueda levantarse y abatirse empleando una sola mano. La altura de la mesa puede ajustarse entre 550 y 930 mm a intervalos de 25 mm si el armazón se fija a la pared, a 250 mm sobre el nivel del suelo. Para alturas superiores a 930 mm el armazón puede montarse a mayor altura.

Precio aproximado en Inglaterra: £ 18.90
impuesto excluido

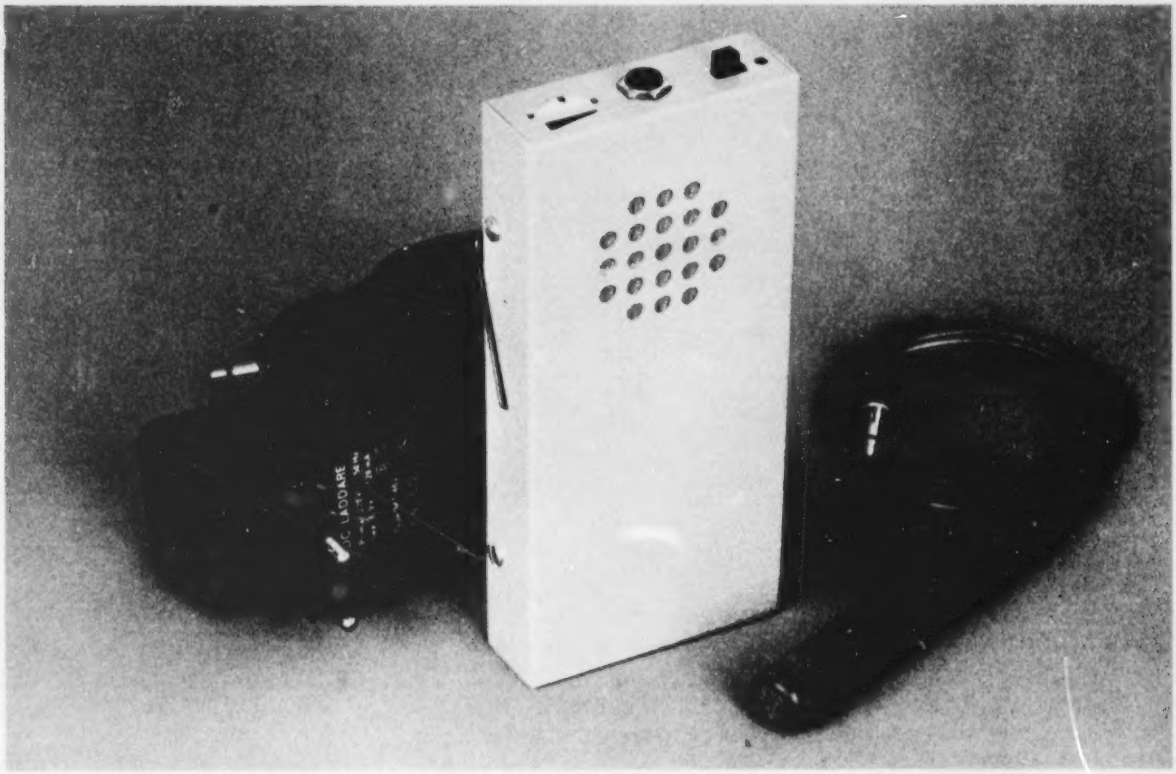
Fabricante:
John R. Edwards & Co.
P.O. Box 13
Marlow
Bucks SL7 3NR
Inglaterra

Las informaciones extraidas de la literatura del fabricante.

POGO PRINT STHLM 1979

SPEECH AMPLIFIER TF-2

A2. 66-1
1978



This communication device is intended for persons with weak voices due to organical or functional disorders and can be used when speaking in small groups. The complete device consists of three components: a metal covered speech amplifier, a microphone made of plastics, and a battery charger. The portable speech amplifier with built-in loud speaker is operated by an on/off slide switch at the top side, where also the volume control and the connection for both microphone and battery charger are placed. The amplifier can be fixed to e. g. a pocket or a belt. The built-in batteries, which are claimed to last 24 hours on a full charge, can be recharged in four hours by inserting the plug of the recharger into the combined microphone/charger outlet at the top. To avoid interference the microphone should be held in a position near the corner of the mouth.

Dimensions

Amplifier:	150 × 67 × 24 mm	270 g
Microphone:	overall diameter	15 mm
	overall length 110 mm	35 g
Battery charger:	70 × 40 × 36/74 mm	180 g
Mains voltage:	220 V/50 Hz alt. 240 V/60 Hz	
Secondary voltage:	6-9 V	

Approx. price in Sweden: SKr 1 375

Manufacturer:
AB Specialinstrument
Box 27066
102 51 Stockholm
Sweden

Tested by the Swedish Institute for the Handicapped and recommended for free prescription in Sweden.

AMPLIFICATEUR DE PAROLE TF-2

Cet appareil de communication est destiné aux personnes dont la voix est faible par suite de lésions organiques ou motrices, pour leur permettre de converser au sein de petits groupes. L'appareil complet se compose de trois éléments: un amplificateur de parole sous enveloppe métallique, un microphone en matière plastique et un chargeur de batteries. L'amplificateur portatif, avec haut-parleur incorporé, est commandé par l'intermédiaire d'un interrupteur coulissant situé à sa partie supérieure, où se trouvent également le réglage de volume et la prise de branchement du microphone et du chargeur de batteries. L'amplificateur peut par exemple s'accrocher à une poche ou se fixer à la ceinture. Les batteries incorporées, dont le constructeur déclare qu'elles ont une autonomie de 24 heures par charge, peuvent être rechargées en quatre heures, en introduisant la fiche du chargeur dans la prise combinée microphone/chargeur, au sommet de l'appareil. Pour éviter toutes interférences, le microphone doit être tenu à proximité de la commissure des lèvres.

Dimensions

Amplificateur:	150 × 67 × 24 mm	270 g
Microphone:	Diamètre total	15 mm
	Longueur totale 110 mm	35 g
Chargeur de batterie:	70 × 40 × 36/74 mm	180 g
Tension secteur:	220 V/50 Hz alt.	
	240 V/60 Hz	
Tension secondaire:	6-9 V	

Prix approximatif en Suède: SKr 1 375

Fabricant:
AB Specialinstrument
Box 27066
102 51 Stockholm
Suède

Essayé par l'Institut suédois pour les handicapés et recommandé pour ordonnance gratuite en Suède.

SPRECHVERSTÄRKER TF-2

Dieses Kommunikationsgerät ist für Personen bestimmt die aufgrund von organischen oder funktionellen Störungen schwache Stimmen haben, und kann bei Unterhaltungen in kleinen Gruppen verwendet werden. Das komplette Gerät besteht aus drei Teilen, nämlich einem blechgekapselten Sprechverstärker, einem Kunststoffmikrofon und einem Batterieladegerät. Der tragbare Sprechverstärker mit eingebautem Lautsprecher wird bedient mit einem an der Oberseite angebrachten Schiebeschalter für "ein – aus", wo auch der Lautstärkeregler und der Anschluss für Mikrofon und Batterieladegerät angebracht sind. Der Verstärker kann an der Tasche getragen oder am Gürtel befestigt werden. Die eingebauten Batterien, die mit voller Ladung nach Angaben des Herstellers für Betriebszeit von 24 Stunden ausreichen, können in vier Stunden wieder aufgeladen werden, wobei der Stecker des Ladegeräts in die kombinierte Steckdose für Mikrofon und Ladegerät oben an dem Gerät einzustecken ist. Um Störungen zu vermeiden, sollte das Mikrofon nahe am Mundwinkel gehalten werden.

Abmessungen

Verstärker:	150 × 67 × 24 mm	270g
Mikrofon:	äusserer Durchmesser	15 mm
	Gesamtlänge 110 mm	35 g
Batterieladegerät:	70 × 40 × 36/74 mm	180 g
Netzspannung:	220 V/50 Hz alt.	
	240 V/60 Hz	
Sekundärspannung:	6-9 V	

Zirkapreis in Schweden: SKr 1 375

Hersteller:
AB Specialinstrument
Box 27066
102 51 Stockholm
Schweden

Getestet von dem schwedischen Behinderteninstitut und für freie Ordination in Schweden empfohlen.

AMPLIFICADOR DE HABLA TF-2

Este dispositivo de comunicación está destinado para personas con voz débil a causa de desórdenes orgánicos o funcionales y puede emplearse al hablar en pequeños grupos. El dispositivo completo consta de tres componentes: un amplificador de voz con cubierta metálica, un micrófono de plástico y un cargador de batería. El amplificador portátil con altavoz incorporado se opera mediante un interruptor deslizante de conexión/desconexión situado en el lado superior, en donde están asimismo emplazados el control del volumen y la conexión para el micrófono y el cargador de batería. El amplificador puede fijarse, por ejemplo, a un bolsillo o cinturón. Las baterías incorporadas, que pueden tener una duración de 24 horas con carga completa, pueden recargarse en cuatro horas introduciendo la clavija del recargador en la salida combinada de arriba. Para evitar interferencias, el micrófono deberá mantenerse cerca de los labios.

Dimensiones

Amplificador:	150 × 67 × 24 mm	270 g
Micrófono:	Diámetro total	15 mm
	Largo total 110 mm	35 g
Recargador de batería:	70 × 40 × 36/74 mm	180 g
Tensión de la red:	220 V/50 Hz alt.	
	240 V/60 Hz	
Tensión secundaria:	6-9 V	

Precio aproximado en Suecia: SKr 1 375

Fabricante:
AB Specialinstrument
Box 27066
102 51 Stockholm
Suecia

Probado por el Instituto Sueco de Incapacitados y recomendado en Suecia por prescripción libre.

POGO PRINT STHLM 1978

TRONICAR

D1. 71-4
1978

This four-wheeled motor vehicle intended for outdoor use has a polyester body mounted on a steel tube frame and is provided with headlight, taillamp and blinker. The vehicle is equipped with two electric motors powered by two 12V batteries, two mechanical brake systems acting on the rear wheels, and an electric motor brake. It is claimed to have a range of 30 km on level ground, a maximum speed of 14 km/hour and to climb a 15% incline. By operating the small controller switch on the steering lever, which can be individually adjusted and placed either to the right or left, the vehicle can be accelerated, slowed down, and by pressure on the lever, stopped. The height of both the floor and the seat, which is equipped with a safety belt can be adjusted. Front safety loop, luggage grid 600 × 300 mm, trailer, support for crutches and plexiglass sheltering roof are available as optional accessories.

Overall length:	112 cm
Overall width:	71 cm
Weight:	170 kg
Turning circle:	110 cm
Approx. price in Switzerland:	SFr 7 250

Manufacturer:
Tronicar Electrodrive AG
Postfach
CH-8621 Wetzikon 4
Switzerland

Information is taken from manufacturer's literature.

TRONICAR

Ce véhicule motorisé à quatre roues, pour utilisation à l'extérieur, comporte une carrosserie en polyester, montée sur un châssis en tubes d'acier, et est muni de phare, de feux arrière et d'indicateurs de direction. Il est équipé de deux moteurs électriques alimentés par deux batteries de 12 V, d'un double système de freinage mécanique agissant sur les roues arrière et d'un frein moteur électrique. Selon son constructeur, il a une autonomie de 30 kilomètres en plat, atteint une vitesse de pointe de 14 km/h et peut gravir des pentes de 15%. Un petit sélecteur de commande, sur le levier de direction, qu'il est possible de régler en fonction des besoins individuels et de monter au choix à droite ou à gauche, permet d'accélérer et de ralentir le véhicule, qu'il suffit d'autre part d'une pression sur le levier pour arrêter. La hauteur du repose-pieds est réglable, ainsi que celle du siège, équipé d'une ceinture de sécurité. Le véhicule peut être complété en option par un arceau de sécurité avant, un porte-bagages de 600 × 300 mm, une remorque, des supports pour béquilles et un toit en plexiglas.

Longueur totale:	112 cm
Largeur totale:	71 cm
Poids:	170 kg
Rayon de braquage:	110 cm
Prix approximatif en Suisse:	SFr 7 250

Fabricant:
Tronicar Electrodrive AG
Postfach
CH-8621 Wetzikon 4
Suisse

Les renseignements ci-dessus sont extraits de la documentation fournie par le fabricant.

TRONICAR

Dieses vierrädrige Motorfahrzeug ist für den Gebrauch im Freien bestimmt und hat eine Polyester-Karosserie, die auf einem Unterbau aus Stahlrohrprofilen angeordnet und mit Fernlicht, Rücklicht und Blinker ausgestattet ist. Das Fahrzeug ist ausgerüstet mit zwei Elektromotoren, die von zwei Batterien mit einer Leistung von jeweils 12 V angetrieben werden, zwei mechanischen Bremseinrichtungen, die auf die Hinterräder wirken, und einer elektrischen Motorbremse. Nach Angaben des Herstellers hat das Fahrzeug einen Aktionsbereich von 30 km auf ebenem Boden, eine maximale Geschwindigkeit von 14 km pro Stunde und ist geeignet für Steigungen bis zu 15 Prozent. Durch Betätigung des kleinen Steuerschalters an dem Lenkhebel, der individuell angepasst und entweder rechts oder links angebracht werden kann, wird die Geschwindigkeit des Fahrzeugs beschleunigt, verzögert und durch Druck auf den Hebel zum Halten gebracht. Die Höhe des Fahrzeugbodens und des Sitzes, der mit einem Sicherheitsgurt ausgestattet ist, kann verstellt werden. Stirnseitige Sicherheitsschlinge, Gepäckträger 600 × 300 mm, Anhänger, Halterung für Krücken und Schutzdach aus Plexiglas können wahlweise gegen Aufpreis mitgeliefert werden.

Gesamtlänge:	112 cm
Gesamtbreite:	71 cm
Gewicht:	170 kg
Wendekreis:	110 cm
Zirkapreis in der Schweiz:	SFr 7 250

Hersteller:
Tronicar Electrodrive AG
Postfach
CH-8621 Wetzikon 4
Schweiz

Die Informationen stammen aus Herstellerliteratur.

TRONICAR

Este vehículo motorizado de cuatro ruedas previsto para utilización al aire libre consta de un cuerpo de poliéster montado sobre un armazón tubular de acero y está provisto de faro, luces de cola e intermitente. El vehículo está equipado con dos motores eléctricos accionados por dos baterías de 12 V. Cuenta con dos sistemas de freno mecánico que actúan sobre las ruedas traseras y un freno de motor eléctrico. Se indica que tiene una autonomía de 30 km en terreno llano, una velocidad máxima de 14 km/hora y que puede subir por declives del 15%. Operando el pequeño interruptor de control en la palanca de dirección, que puede ajustarse individualmente y colocarse a la derecha o a la izquierda, el vehículo puede acelerarse, reducirse la marcha y, presionando la palanca, detenerse. Puede ajustarse la altura del suelo y del asiento. Este último está equipado con un cinturón de seguridad. Como accesorios extra puede obtenerse una protección delantera, una rejilla para equipaje de 600 × 300 mm, remolque, soporte de bastones y un techo de plexiglás.

Largo total:	112 cm
Anchura total:	71 cm
Peso:	170 kg
Radio de giro:	110 cm
Precio aproximado en Suiza:	SFr 7 250

Fabricante:
Tronicar Electrodrive AG
Postfach
CH-8621 Wetzikon 4
Suiza

Las informaciones extraidas de la literatura del fabricante.

POGO PRINT STHLM 1978

BATRICAR

D1. 71-3
1978

This four-wheeled electrically driven vehicle intended for outdoor use has a rustproof fibreglass body mounted on a chassis made of tubular steel. It is provided with a low foot-platform and a flat seat with folding armrests to allow easy access. The standard model is powered by two 12 V traction batteries, which can be recharged overnight by means of the provided charger operating on household mains. Only one hand is required to drive this vehicle which is claimed to have a range of 20 miles, a top speed of 4 miles per hour and to climb 1-in-4 gradients as well as a 4'' kerb. All controls including the forward off/reverse lever, the battery meter and the keyswitch are grouped together on the steering tiller. The two-wheel disc brake on the rear wheels is operated by pressing the spring-loaded tiller. Safety straps, lights with direction indicators, cane clips, trailer as well as a fibreglass bonnet and a wheeled shopping bag to be carried behind the seat are available as optional accessories.

Overall length:	58''
Overall width:	28''
Seat height:	22''
Weight with one battery:	219 lbs
Approx. price in the U.K.:	£ 666

Manufacturer:
Braune Batricar Ltd.
Griffin Mill
Thrupp, Stroud
Gloucestershire GL5 2AZ
England

Information is taken from manufacturer's literature.

BATRICAR

Ce véhicule à quatre roues et traction électrique, pour utilisation à l'extérieur, comporte une carrosserie en fibre de verre insensible à la rouille, montée sur un châssis en tubes d'acier. Il est muni d'un repose-pieds surbaissé et d'un siège plat, à accoudoirs rabattables pour en faciliter l'accès. Le modèle standard est alimenté par deux batteries de 12 V, qu'il est possible de recharger durant la nuit au moyen d'un chargeur également fourni, fonctionnant sur secteur. Il suffit d'une main pour conduire ce véhicule qui, selon son constructeur, a une autonomie de 32 kilomètres, peut atteindre une vitesse de pointe de 6,5 km/h et est capable de gravir des pentes de 25 %, ainsi que des bordures de trottoirs hautes de 10 cm. Toutes les commandes, y compris le levier de marche AV/marche AR, l'indicateur de charge et la clé de contact, sont groupés sur la colonne de direction. Pour actionner les freins à disques agissant sur les roues arrière, il suffit d'appuyer sur cette même colonne de direction, montée sur ressorts. Le véhicule peut être complété en option par une ceinture de sécurité, des phares et des indicateurs de direction, des supports pour cannes, une remorque, un capot en fibre de verre et une poussette à provisions se fixant derrière le siège.

Longueur totale:	147 cm
Largeur totale:	71 cm
Hauteur du siège:	56 cm
Poids avec une batterie:	99 kg
Prix approximatif en Angleterre:	£ 666

Fabricant:
Braune Batricar Ltd.
Griffin Mill
Thrupp, Stroud
Gloucestershire GL5 2AZ
Angleterre

Les renseignements ci-dessus sont extraits de la documentation fournie par le fabricant.

BATRICAR

Dieses vierrädrige elektrisch angetriebene Fahrzeug ist für den Gebrauch im Freien bestimmt und hat eine rostfreie Faserglaskarosserie, die auf dem Fahrgestell aus Stahlrohrprofilen angeordnet ist. Es ist ausgestattet mit einer tief liegenden Fusstütze und einem flachen Sitz mit schwenkbaren Armlehnen, um leichtes Ein- und Aussteigen zu ermöglichen. Das Standardmodell wird angetrieben von zwei Fahrzeugbatterien mit einer Leistung von jeweils 12 Volt, die über Nacht mit dem zugehörigen Ladegerät, das an das Hausstromnetz angeschlossen wird, aufgeladen werden können. Zum Bedienen dieses Fahrzeugs, das nach Angaben des Herstellers eine Reichweite von etwa 32 km und eine Höchstgeschwindigkeit von etwa 6,5 km pro Stunde hat, sowie Steilhänge von 1 zu 4 und Bordsteine von 10 cm Höhe bewältigen kann, ist nur eine Hand erforderlich. Sämtliche Bedienteile, einschliesslich des Hebels für Vorwärts-und Rückwärtsfahrt, des Batterieprüfgeräts und des Schlüsselschalters sind an der Lenksäule zusammengefasst. Die Scheibenbremse der Hinterräder wird betätigt durch Drücken des federbelasteten Lenkhebels. Sicherheitsgurte, Blinker, Stockklemmen, Anhänger sowohl wie eine Kühlerhaube aus Fasergias und eine fahrbare Einkaufstasche hinter dem Sitz können gegen Aufpreis wahlweise mitgeliefert werden.

Gesamtlänge:	147 cm
Gesamtbreite:	71 cm
Sitzhöhe:	56 cm
Gewicht mit einer Batterie:	99 kg
Zirkapreis in England:	£ 666

Hersteller:
Braune Batricar Ltd.
Griffin Mill
Thrupp, Stroud
Gloucestershire GL5 2AZ
England

Die Informationen stammen aus Herstellerliteratur.

BATRICAR

Este vehículo de cuatro ruedas accionado eléctricamente está previsto para desplazarse al aire libre y se compone de un cuerpo de fibra de vidrio a prueba de corrosión, montado sobre un chasis tubular de acero. Va provisto de una plataforma baja para los pies y un asiento plano con apoyabrazos plegables para permitir un fácil acceso. El modelo standard está accionado por dos baterías de 12 V que pueden cargarse durante la noche en la red eléctrica doméstica mediante un cargador. Sólo se necesita una mano para conducir este vehículo, que tiene una autonomía de 32 km, una velocidad máxima de aprox. 6,5 km por hora y que puede subir por declives de 25%, al igual que bordillos de 10 cm. Todos los mandos, incluyendo la palanca de desconexión avance/retroceso, el indicador de carga en las baterías y el contacto de llave están agrupados en el órgano de dirección. El freno de discos situado en las ruedas traseras se actúa presionando la palanca con resorte. Como accesorios extra pueden obtenerse cinturón de seguridad, alumbrado con indicaciones de dirección, sujetadores de bastones, remolque y casco de fibra de vidrio, así como un cesto de ruedas para la compra que puede llevarse detrás del asiento.

Largo total:	147 cm
Anchura total:	71 cm
Altura del asiento:	56 cm
Peso con una bateria:	99 kg
Precio aproximado en Inglaterra:	£ 666

Fabricante:
Braune Batricar Ltd.
Griffin Mill
Thrupp, Stroud
Gloucestershire GL5 2AZ
Inglaterra

Las informaciones extraidas de la literatura del fabricante.

POGO PRINT STHLM 1978

TROLLEY AID

D1. 23-11
1978

This trolley has been designed for disabled persons to give walking support and to facilitate the carrying of e. g. meals and small domestic or personal items. The frame is made of 5/8'' square sectioned steel tube, and is mounted on four twin wheel castors. The removable top tray, approximately 20 × 12'', made of heat- and stain-resistant melamine coated board is recessed in the steel frame at conventional table top height. The lower metal box, approximately 20 × 6 3/4 × 4'', is at convenient height to be reached from a sitting position. The trolley is available with three alternative and interchangeable types of walking support: either with walking stick handles, a horizontal handle-bar or with forearm trough supports, all with moulded plastic grips and adjustable over a range of 5 inches.

Height:	30 ¼''
Width:	21 ½''
Length:	20 ¼''
Weight:	20 ½ lbs

Approx. price in the U.K. excl. tax.:

Basic trolley with stick handles or handle-bar support	£ 33.00
Trough supports	£ 13.50/pair
Stick handles	£ 1.50/pair
Handle-bar	£ 1.50

Manufacturer:
Haven Products Ltd.
Longman Road
Inverness 1V1 1RY
Scotland

Information is taken from manufacturer's literature.

TABLE ROULANTE

Cette table roulante est spécialement conçue pour aider les personnes handicapées à marcher et leur permettre de transporter plus facilement un plateau de repas ou de petits objets domestiques ou personnels par exemple. Le cadre, en tubes d'acier à section carrée de 16 mm, est muni de quatre roulettes jumelées. Le plateau supérieur, d'environ 51 × 30,5 cm et constitué d'un panneau aggloméré recouvert de mélamine résistant à la chaleur et aux taches, est encastré dans le cadre en acier à hauteur de table normale. Le casier inférieur en métal, dont les dimensions sont environ 51 × 17 × 10 cm, se trouve à bonne hauteur pour un utilisateur assis. La table roulante est disponible avec trois variantes interchangeables d'appuis: poignées type cannes, barre horizontale ou supports en auge pour avant-bras, avec dans les trois cas des manchons plastiques moulés et une possibilité de réglage en hauteur dans une plage de 13 cm.

Hauteur:	76,74 cm
Largeur:	54,61 cm
Longueur:	51,44 cm
Poids:	9,30 kg

Prix approximatif en Angleterre H.T.:

Modèle de base avec poignées de cannes ou barre horizontale	£ 33.00
Supports pour avant-bras	£ 13.50/paire
Poignées de cannes	£ 1.50/paire
Barre horizontale	£ 1.50

Fabricant:
Haven Products Ltd.
Longman Road
Inverness 1V1 1RY
Scotland

Les renseignements ci-dessus sont extraits de la documentation fournie par le fabricant.

MEHRZWECKWÄGELCHEN

Dieses Wägelchen wurde entwickelt für Behinderte, um sie beim Gehen zu stützen und das Transportieren von Mahlzeiten und kleineren Gebrauchsgegenständen oder persönlichen Sachen zu erleichtern. Das Gestell ist aus 16 mm Vierkantstahlrohrprofilen gefertigt und mit vier Doppellaufrollen ausgestattet. Das oben im Gestell befestigte abnehmbare Tablett hat eine Grösse von etwa 51 × 30,5 cm und besteht aus melaminbeschichtetem, hitze-und fleckenbeständigem Material, angebracht in der Höhe einer normalen Tischplatte. Der unten im Gestell befestigte Blechkasten ist 51 × 17 × 10 cm gross und in angemessener Höhe um in sitzender Stellung erreicht werden zu können. Dieses Wägelchen ist erhältlich mit drei unterschiedlichen Gehstützen, die untereinander ausgetauscht werden können, d.h. entweder mit Spazierstockgriffen, einem horizontalen Lenker oder mit Unterarmstützen; alle drei Ausführungen sind ausgestattet mit Formkunststoffgriffen und einstellbar über einen Bereich von 13 cm.

Höhe:	76,84 cm
Breite:	54,61 cm
Länge:	51,44 cm
Gewicht:	9,30 kg

Zirkapreis in England exkl. Steuer:

Wägelchen in Grundausführung mit Spazierstockgriffen oder Lenker:	£ 33.00
Unterarmstützen:	£ 13.50/Paar
Spazierstockgriffe:	£ 1.50/Paar
Lenker:	£ 1.50

Hersteller:
Haven Products Ltd.
Longman Road
Inverness 1V1 1RY
Scotland

Die Informationen stammen aus Herstellerliteratur.

CARRETILLA DE AYUDA

Esta carretilla ha sido diseñada para dar apoyo al andar a los minusválidos y facilitarles el acarreo de comidas y pequeños artículos domésticos o personales. Consta de un armazón de tubo de acero de sección cuadrada de 16 mm, y descansa sobre cuatro pares de ruedecillas. La bandeja superior, de aprox. 51 × 30,5 cm, hecha de tablero revestido de melamina resistente al calor y a las manchas, está adentrada en la estructura, y situada a la altura normal de una mesa. El compartimento de metal inferior, de aprox. 51 × 17 × 10 cm está a un nivel conveniente, y es accesible desde la posición sentada. La carretilla puede obtenerse con tres tipos alternativos e intercambiables de apoyo para andar: con empuñaduras, con asa horizontal o con soportes de antebrazo cóncavos. Todas las versiones tienen unas superficies de sujeción de plástico moldeado y pueden ajustarse dentro de un campo de aprox. 13 cm.

Altura:	76,74 cm
Anchura:	54,61 cm
Largo:	51,44 cm
Peso:	9,30 kg

Precio aproximado en Inglaterra impuesto excluido:

Carretilla básica con empuñaduras o con asa horizontal	£ 33.00
Soportes de antebrazo	£ 13.50/par
Empuñaduras	£ 1,50/par
Asa horizontal	£ 1.50

Fabricante:
Haven Products Ltd.
Longman Road
Inverness 1V1 1RY
Escocia

Las informaciones extraidas de la literatura del fabricante.

POCO PRINT STHLM 1979